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(71) Applicants (for all designated States except US): UNI-
VERSITY COLLEGE CARDIFF CONSULTANTS
LIMITED [GB/GB]; P.O. Box 497, 30-36 Newport
Road, Cardiff CF24 0DE (GB). REGA FOUNDATION
[BE/BE]; Minderbroedersstraat 10, B-3000 Leuven (BE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): McGUIGAN,
Christopher [GB/GB]; 2 Alfreda Road, Whitchurch,
Cardiff CF4 2EH (GB). BALZARINI, Jan [BE/BE];
Kapeldreef 20, B-3001 Heverlee (BE). DE CLERCQ,
Erik [BE/BE]; Parklaan 9, B-3360 Lovenjoel (BE).

(74) Agents: HOWARD, Paul, Nicholas et al.; Carpmaels &
Ransford, 43-45 Bloomsbury Square, London WC1A 2RA
(GB).

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(54) Title: HETEROCYCLIC COMPOUNDS FOR USE IN THE TREATMENT OF VIRAL INFECTIONS

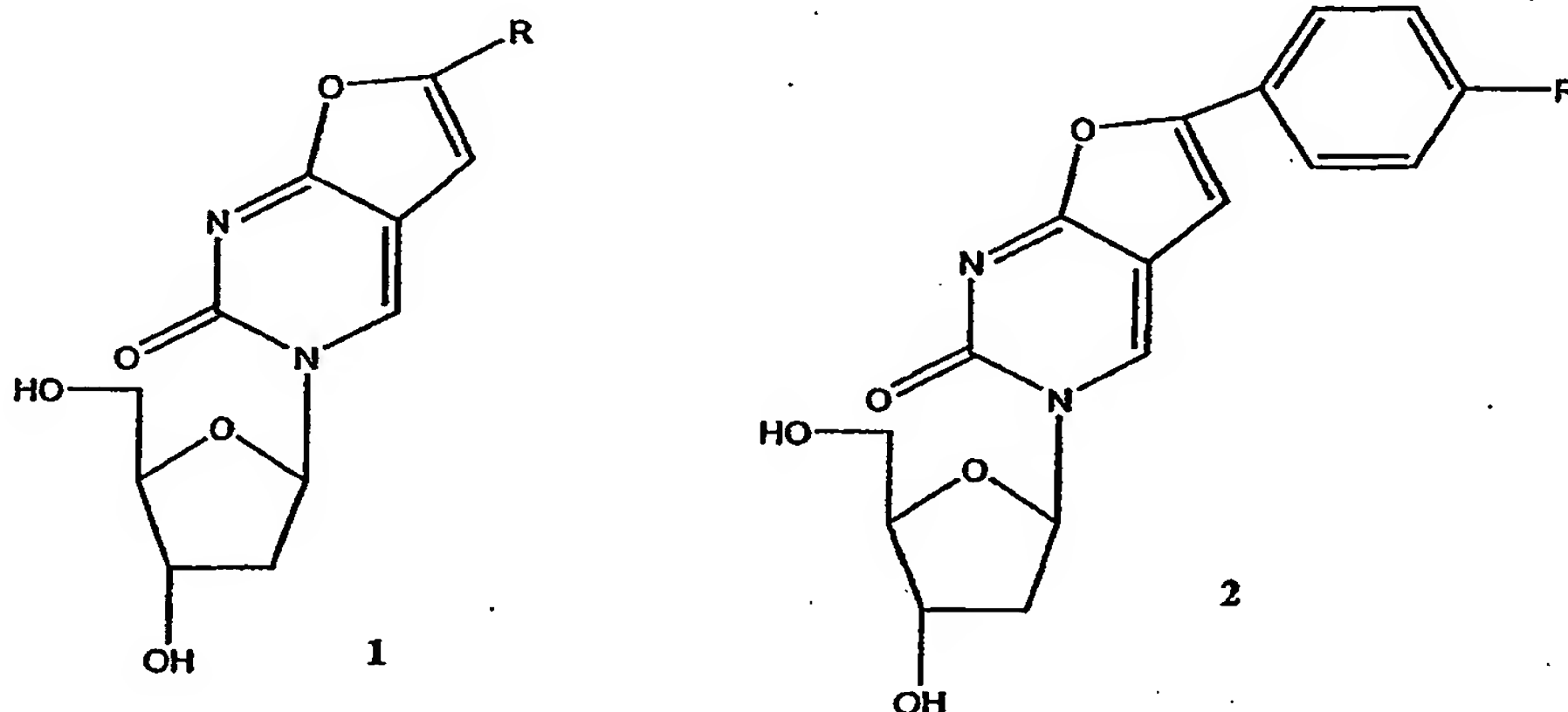
(57) Abstract: 6-substituted-3-substituted-3H-furo[2,3-d]pyrimidin-2-one and 6-substituted-2-substituted-furo[2,3-d]pyrimidine
novel compounds are useful in the treatment of viral infection, in particular cytomegalovirus viral infection. The substituents are
independently selected from alkyl, aryl, alkenyl and alkynyl. The preferred substituent at the 6 position is alkyl.

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HETEROCYCLIC COMPOUNDS FOR USE IN THE TREATMENT OF VIRAL INFECTIONS

The present invention relates to a chemical compound and to its therapeutic use in the prophylaxis and treatment of viral infection for example human herpes viruses, particularly
5 and human cytomegalovirus (HCMV). Cytomegalovirus is the aetiological agent in CMV retinitis and other viral infections, which can cause considerable human illness and suffering.

It has previously been noted that nucleoside analogues of the structural types 1 and 2
10 exhibit a potent and selective antiviral effect (McGuigan *et al* J. Med. Chem. 1999, 42, 4479-84 and J. Med. Chem. 2000, 43, 4993-97):



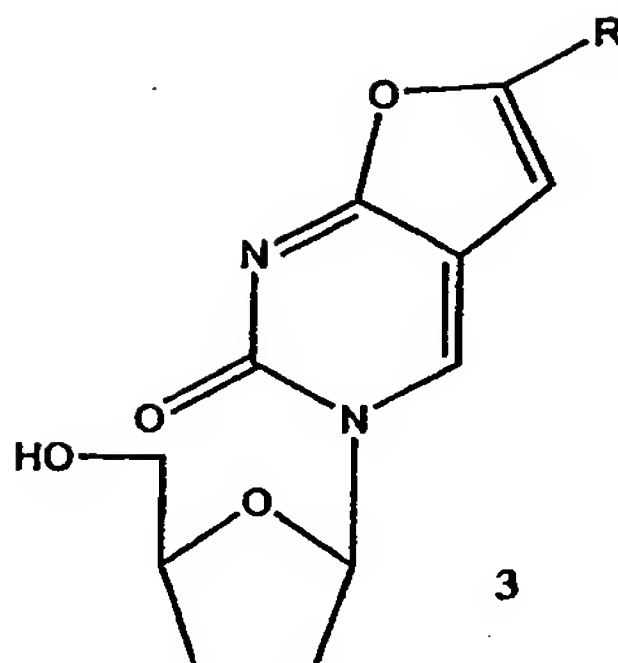
15 Optimal structures are 1, R=C8-C10 and 2, R=pC₅Ph. Further details are given in WO 98/49177 and WO 01/83501, respectively. The compounds exclusively inhibit Varicella zoster virus (VZV) in a VZV – thymidine-kinase dependent fashion, functioning in a classical nucleoside analogue manner, of obligate intracellular nucleoside kinase-mediated activation (Balzarini *et al*, Mol. Pharmacol. 61, 249-254, 2002).

20

It has recently been noted that dideoxynucleoside analogues of 1 have a pronounced but quite distinct activity against another member of the herpes family, namely human cytomegalovirus HCMV. The optimal structure of these agents was identified as 3 and is described in WO 01/85749.

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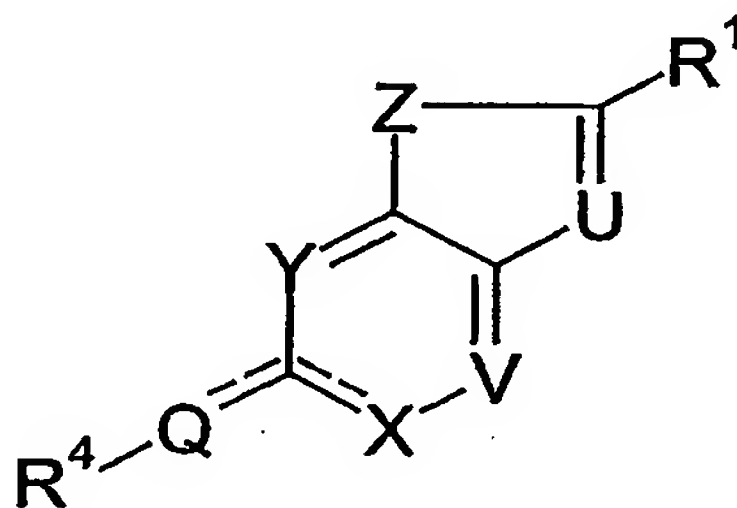
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- 10 These agents would have been expected to act via a classical nucleoside mechanism, requiring 5'-phosphorylation before they would exhibit antiviral activity. As such a 5'-OH and a quasi-nucleoside structure with a sugar or close analogue was deemed necessary.

It is an object of the present invention to provide novel compounds, in particular novel
15 compounds not requiring phosphorylation for, for example, biological activity.

It is a further object of the present invention to provide novel compounds for therapeutic use in the prophylaxis and treatment of viral infection, for example, by cytomegalovirus.

- 20 According to the present invention there is provided a chemical compound having the formula (I):



wherein:

- 25 R^1 and R^4 are independently selected from alkyl, aryl, alkenyl and alkynyl;

Z is selected from O, NH, S, Se, NR^5 and $(\text{CH}_2)_n$ where n is 1 to 10, and CT_2 where T may be the same or different and is selected from hydrogen, alkyl and halogens, and R^5 is alkyl, alkenyl or aryl;

5 Y is selected from N, CH and CR^6 where R^6 is alkyl, alkenyl, alkynyl or aryl;

Q is selected from O, S, NH, N-alkyl, CH_2 , CHalkyl and C(alkyl)_2 ;

10 U is selected from N and CR^2 where R^2 is selected from hydrogen, alkyl, halogens, amino, alkylamino, dialkylamino, nitro, cyano, alkoxy, aryloxy, thiol, alkylthiol, arylthiol and aryl;

V is selected from N and CR^3 where R^3 is selected from hydrogen, alkyl, halogens, alkyloxy, aryloxy and aryl;

15

and when a double bond exists between X and the ring atom to which Q is attached and Q is linked to the ring moiety by a single bond, X is selected from N, CH and CR^7 , where R^7 is selected from alkyl, alkenyl, alkynyl and aryl; and

20 when a double bond links Q to the ring moiety and a single bond exists between X and the ring atom to which Q is attached, R^4 does not exist and X is NR^8 , where R^8 is alkyl, alkenyl, alkynyl or aryl, except that when Y is N, U is CR^2 and V is CR^3 , R^8 is not an alkyl or alkenyl group substituted at the fourth atom of the chain of said alkyl or alkenyl group, counted along the shortest route away from the ring moiety including any hetero atom
25 present in said chain, by a member selected from OH, phosphate, diphosphate, triphosphate, phosphonate, diphosphonate, triphosphonate and pharmacologically acceptable salts, derivatives and prodrugs thereof;

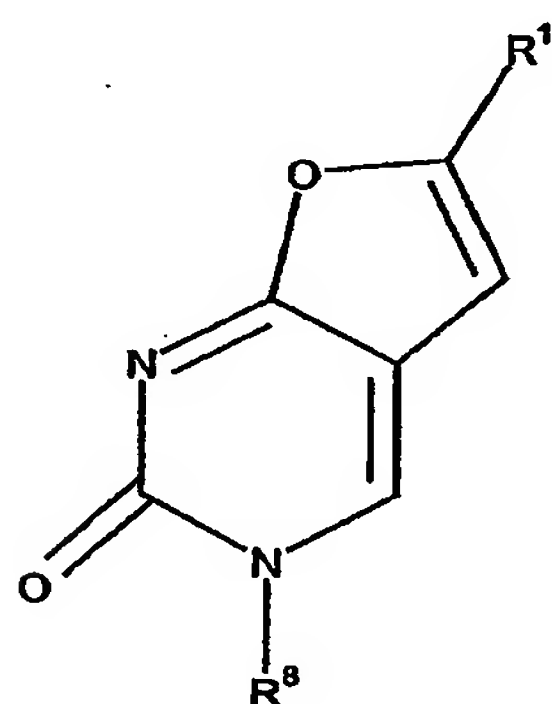
and pharmacologically acceptable salts, derivatives and prodrugs of compounds of formula
30 (I).

Surprisingly the dideoxysugar in prior art compounds known from WO 01/85749 (structure 3 above) can be replaced by an alkyl, alkenyl, alkynyl or aryl moiety that does

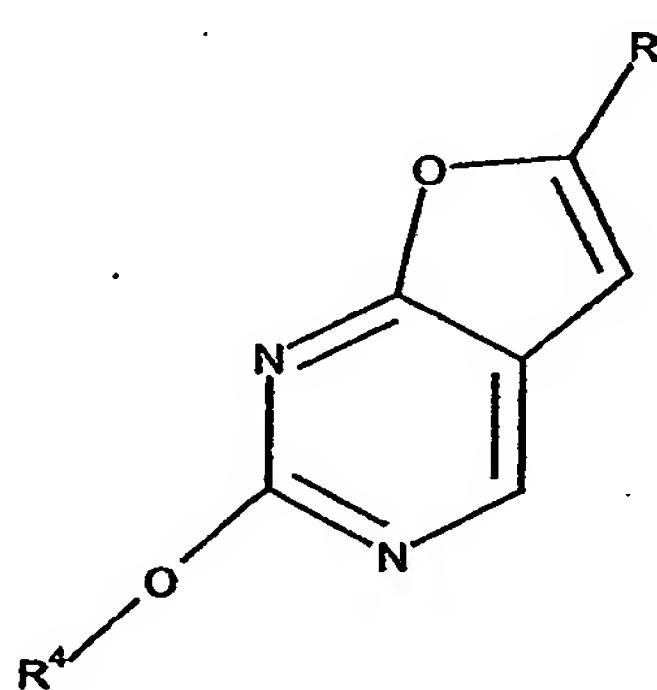
not require phosphorylation for biological activity and hence does not require the hydroxy or any groups on the, for example, alkyl C₄ atom deemed necessary for phosphorylation.

Preferably neither R⁴ nor R⁸ contains any suitable hydroxy group that may be subject to biological phosphorylation. In particular, preferably neither R⁴ nor R⁸ is a ribose, deoxyribose, dideoxyribose, dideoxydidehydroribose sugar or similar sugar group or close analogue.

Compounds having a double bond between X and the ring atom to which Q is attached are isomers of compounds having a single bond between X and the ring atom to which Q is attached. Compounds having a double bond between X and the ring atom to which Q is attached are entirely non-nucleosidic in nature. Examples of these two isomers are, for instance, structures 4 and 5:



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Varying the composition of R¹, R⁴ and R⁸ of formula (I) determines the biological activity of the compounds.

Preferably Z is O or NH. Where Z is N-alkyl, suitably the alkyl is C₁ to C₅ alkyl.

Preferably Y is N.

Preferably Q is CH₂, S or O. More preferably Q is O. Where Q is N-alkyl, suitably the alkyl is C₁ to C₅ alkyl. Where Q is CHalkyl or C(alkyl)₂, suitably the alkyl is C₁ to C₅ alkyl.

Preferably each of U and V is CH.

When a double bond exists between X and the ring atom to which Q is attached, X and Y
5 are preferably both N.

When a double bond exists between X and the ring atom to which Q is attached, Z is preferably O.

10 When a double bond exists between X and the ring atom to which Q is attached, Q is preferably O.

When X and Y are N, Q and Z are independently preferably selected from O, S and NH, more preferably Q and Z are O.

15

Throughout the present specification:

alkyl includes cycloalkyl, alkyl substituted with cycloalkyl, alkyl containing within the alkyl chain 1, 2, 3 or 4 heteroatoms selected independently from O, S and N, substituted
20 alkyl and branched alkyl;

alkenyl includes cycloalkenyl, alkyl substituted with cycloalkenyl, alkenyl containing within the alkenyl chain 1, 2, 3 or 4 heteroatoms selected independently from O, S and N for example tetrahydrofuran (THF), substituted alkenyl and branched alkenyl;

25

alkynyl includes cycloalkynyl, alkyl substituted with cycloalkynyl, alkynyl containing within the alkynyl chain 1, 2, 3 or 4 heteroatoms selected independently from O, S and N, substituted alkynyl and branched alkynyl; and

30 aryl includes monocyclic and bicyclic fused 5, 6 and 7 membered aromatic rings, aryl containing 1, 2, 3 or 4 heteroatoms selected independently from O, S and N, alkylaryl for example benzyl, and substituted aryl and substituted alkylaryl for example substituted benzyl.

The nature, position and number of any substituents and unsaturation present in any alkyl, alkenyl, alkynyl and aryl group may be varied.

- 5 Examples of suitable substituents on any of said alkyl, alkenyl, alkynyl and aryl, including alkylaryl, groups include OH, halogens, amino, CN, COOH, CO₂alkyl(C₁ to C₅), CONH₂, CONHalkyl(C₁ to C₅), O-alkyl(C₁ to C₅), SH, S-alkyl(C₁ to C₅) and NO₂, and aryl(5 to 10 ring atoms), and with respect to aryl and alkylaryl groups include alkyl (C₁ to C₅), alkenyl (C₂ to C₅) and alkynyl (C₂ to C₅), wherein any of said alkyl, alkenyl, alkynyl and aryl
- 10 moieties are each optionally substituted. Substituents on the said alkyl, alkenyl and alkynyl moieties, which are preferably straight chain, can be selected from the group comprising OH, halogens, amino, CN, SH and NO₂, and is preferably a halogen, more preferably chlorine. Where the said alkyl, alkenyl or alkynyl moiety is C₂ to C₅, the substituent is preferably at the terminus position. Substituents on the said aryl moiety can
- 15 be selected from the group comprising OH, halogens, amino, CN, NO₂, and C₁ to C₁₀ alkyl, which C₁ to C₁₀ alkyl moiety is optionally substituted with a member selected from the group comprising OH, halogens, amino, CN, SH, NO₂. The said aryl moiety can comprise aryl or heteroaryl groups. Any ring heteroatoms may vary in position or number. Suitably 1, 2, 3 or 4 heteroring atoms may be present, preferably selected, independently,
- 20 from O, N and S. The said aryl moiety can comprise one, or two fused, 5, 6 or 7 membered rings.

Preferably R¹ is selected from C₃₋₂₀alkyl, C₃₋₂₀cycloalkyl, C₂₋₂₀alkenyl, C₃₋₂₀alkynyl, C₅₋₁₄ aryl and C₁₋₁₀alkylC₅₋₁₄aryl, more preferably C₃₋₁₄alkyl, C₃₋₁₄alkenyl, C₃₋₁₄alkynyl, more

25 preferably C₆₋₁₄alkyl, C₆₋₁₄alkenyl, C₆₋₁₄alkynyl, even more preferably C₈₋₁₀alkyl, C₈₋₁₀ alkenyl and C₈₋₁₀alkynyl.

Preferably R¹ is C₄₋₁₄alkyl, C₄₋₁₄alkenyl or C₄₋₁₄alkynyl, more preferably C₄₋₁₂alkyl, C₄₋₁₂alkenyl or C₄₋₁₂alkynyl, even more preferably C₆₋₁₀alkyl, C₆₋₁₀alkenyl or C₆₋₁₀alkynyl,

30 even more preferably C₈₋₁₀alkyl, C₈₋₁₀alkenyl or C₈₋₁₀alkynyl.

Where there is a single bond between X and the ring atom to which Q is attached, R¹ is preferably C₆₋₁₂alkyl, C₆₋₁₂alkenyl or C₆₋₁₂alkynyl.

Where there is a double bond between X and the ring atom to which Q is attached, R¹ is preferably C₄₋₁₂alkyl, C₄₋₁₂alkenyl or C₄₋₁₂alkynyl.

- 5 Preferably R¹ is an alkyl group. Preferably R¹ is a straight chain alkyl group. Preferably R¹ is an unsubstituted alkyl group. Preferably R¹ is a saturated alkyl group.

Preferably R¹ is a C₇ to C₁₃ alkyl group. More preferably R¹ is a C₈ to C₁₂ alkyl group, even more preferably a C₉ to C₁₁ alkyl group. Particularly preferred is R¹ being a C₉ or C₁₀
10 alkyl group.

Where R¹ is a straight chain alkyl group, a preferred position for substitution is the terminus position.

- 15 Suitably any substituent in R¹ is non-polar, more suitably any such substituent is additionally hydrophobic. Preferred substituents on R¹ include halogen and O-alkyl(C₁ to C₅). Particularly preferred is O-alkyl with C₄, optionally terminally substituted with a halogen, preferably chlorine.

- 20 When R¹ is a cycloalkyl group, it suitably comprises 5 to 12 ring carbon atoms arranged in one or two adjoining rings.

Preferably R¹ is selected from the group comprising nC₄H₉, nC₆H₁₃, nC₇H₁₅ and nC₁₀H₂₁. Preferably R¹ is nC₁₀H₂₁.

25

Preferably R⁴ and R⁸ are selected from C₁₋₁₂alkyl, C₂₋₁₂alkenyl, C₂₋₁₂alkynyl, C₃₋₁₂cycloalkyl, C₁₋₆alkyl substituted with C₃₋₁₀cycloalkyl, C₅₋₁₄aryl and C₁₋₅alkylC₅₋₁₄aryl.

- Preferably R⁴ and R⁸ are selected from C₁₋₁₀alkyl C₂₋₁₀alkenyl, C₂₋₁₀alkynyl, C₁alkyl
30 substituted with C₅₋₆cycloalkyl and C₁alkyl substituted with C₅₋₇aryl.

Even more preferably R⁴ and R⁸ are selected from C₁₋₆alkyl, C₂₋₄alkenyl, C₁alkyl substituted with C₅₋₆cycloalkyl and benzyl and substituted benzyl.

Preferably each of R^4 and R^8 are selected from the group comprising cycloC₅H₉, CH(Et)₂, nC₅H₁₁, 2-THF, CH₂cycloC₆H₁₁, 3-THF, cycloC₆H₁₁, C₃H₇, nC₄H₉, PhCH₂, TolCH₂, pMeOPhCH₂, CH₂cycloC₅H₉, Me and nC₃H₇.

5

Where a single bond exists between X and the ring atom to which Q is attached particularly preferred combinations of R^1 and R^8 are, respectively, nC₇H₁₅ and cycloC₅H₉, nC₇H₁₅ and CH(Et)₂, nC₁₀H₂₁ and 3-THF, nC₁₀H₂₁ and cycloC₆H₁₁, nC₁₀H₂₁ and C₃H₇, nC₁₀H₂₁ and CH₂cycloC₅H₉, nC₆H₁₃ and Me, nC₆H₁₃ and nC₃H₇, and nC₆H₁₃ and PhCH₂.

10 A particularly preferred combination is R^1 being nC₁₀H₂₁ and R^8 being CH₂cycloC₅H₉.

Where a double bond exists between X and the ring atom to which Q is attached particularly preferred combinations of R^1 and R^4 are, respectively, nC₄H₉ and cycloC₅H₉, nC₇H₁₅ and cycloC₅H₉, nC₇H₁₅ and CH(Et)₂, nC₇H₁₅ and nC₅H₁₁, nC₁₀H₂₁ and CH(Et)₂,
 15 nC₁₀H₂₁ and cycloC₆H₁₁, nC₁₀H₂₁ and nC₃H₇, nC₁₀H₂₁ and nC₄H₉, nC₁₀H₂₁ and PhCH₂, nC₁₀H₂₁ and CH₂cycloC₆H₁₁, nC₁₀H₂₁ and TolCH₂, nC₁₀H₂₁ and pMeOPhCH₂, nC₆H₁₃ and Me, nC₆H₁₃ and nC₄H₉, and nC₆H₁₃ and PhCH₂. Particularly preferred combinations are R^1 being nC₁₀H₂₁ with R^4 being any of nC₃H₇, nC₄H₉, PhCH₂, CH₂cycloC₆H₁₁, tolCH₂, and pMeOPhCH₂.

20

Suitably R^2 is selected from the group comprising H, C₁ to C₁₀ alkyl, C₃ to C₁₀ cycloalkyl, C₁ to C₁₀ alkylamino, C₁ to C₁₀ dialkylamino, C₁ to C₁₀ alkyloxy, C₆ to C₁₀ aryloxy, C₁ to C₁₀ alkylthiol, C₆ to C₁₀ arylthiol and C₆ to C₁₀ aryl.

25 Suitably R^3 is selected from the group comprising H, C₁ to C₁₀ alkyl, C₃ to C₁₀ cycloalkyl, C₁ to C₁₀ alkyloxy, C₆ to C₁₀ aryloxy and C₆ to C₁₀ aryl.

Preferably each of R^2 and R^3 is a small alkyl i.e. a C₁ to C₂ alkyl group or H. More preferably each of R^2 and R^3 is H.

30

Throughout the present specification "halogen" is taken to include any of F, Cl, Br and I.

Where not otherwise specified, alkyl is C₁₋₆alkyl, alkenyl is C₂₋₆alkenyl, alkynyl is C₂₋₆alkynyl, aryl is C₅₋₁₄aryl and alkylaryl is C₁₋₆alkylC₅₋₁₄aryl.

Where R¹, R⁴ or R⁸ is an aryl group, the group includes alkylaryl groups. Preferably R¹, R⁴ and R⁸ are C₅₋₁₄aryl groups or C₁₋₄alkylC₅₋₁₄ aryl groups. Particularly preferred groups are benzyl and substituted benzyl such as toluene (tol)CH₂, and pMeOPhCH₂. Preferred substituents include alkyl (C₁₋₆), alkoxy (C₁₋₆) and halogen (F, Cl, Br and I). The preferred substitution positions for phenyl and benzyl is para. Preferred aryl groups are C₆.

- 10 Where there is a single bond between X and the ring atom to which Q is attached:
- when R¹ is alkyl, preferably R¹ is C₆₋₁₂alkyl;
 - when R¹ is alkynyl, preferably R¹ is C₈ or above alkynyl, more preferably C₈₋₂₀alkynyl, even more preferably C₈₋₁₄alkynyl; even more preferably C₈₋₁₂alkynyl; even more preferably C₈₋₁₀alkynyl;
 - 15 when R¹ is aryl, preferably R¹ is a monocyclic or bicyclic fused 5, 6 or 7 membered ring, an aryl group containing 1, 2, 3 or 4 heteroatoms selected independently from O, S and N, alkylaryl for example benzyl, or substituted aryl or substituted alkylaryl for example substituted benzyl such as pMeOPhCH₂, more preferably a C₅₋₁₄aryl group or a C₁₋₄alkylC₅₋₁₄ aryl group, even more preferably a C₆ aryl group,
 - 20 the substituents being as set out above;
 - when R¹ is alkyl containing within the alkyl chain 1, 2, 3 or 4 heteroatoms selected independently from O, S and N, preferably R¹ is not a thioether, even more preferably R¹ being a thioether is excluded from the scope of formula (I); and/or
 - when R⁸ is alkyl, R⁸ is not methyl when R¹ is n-butyl, Y is N, Z is O and V and U
 - 25 are CH.

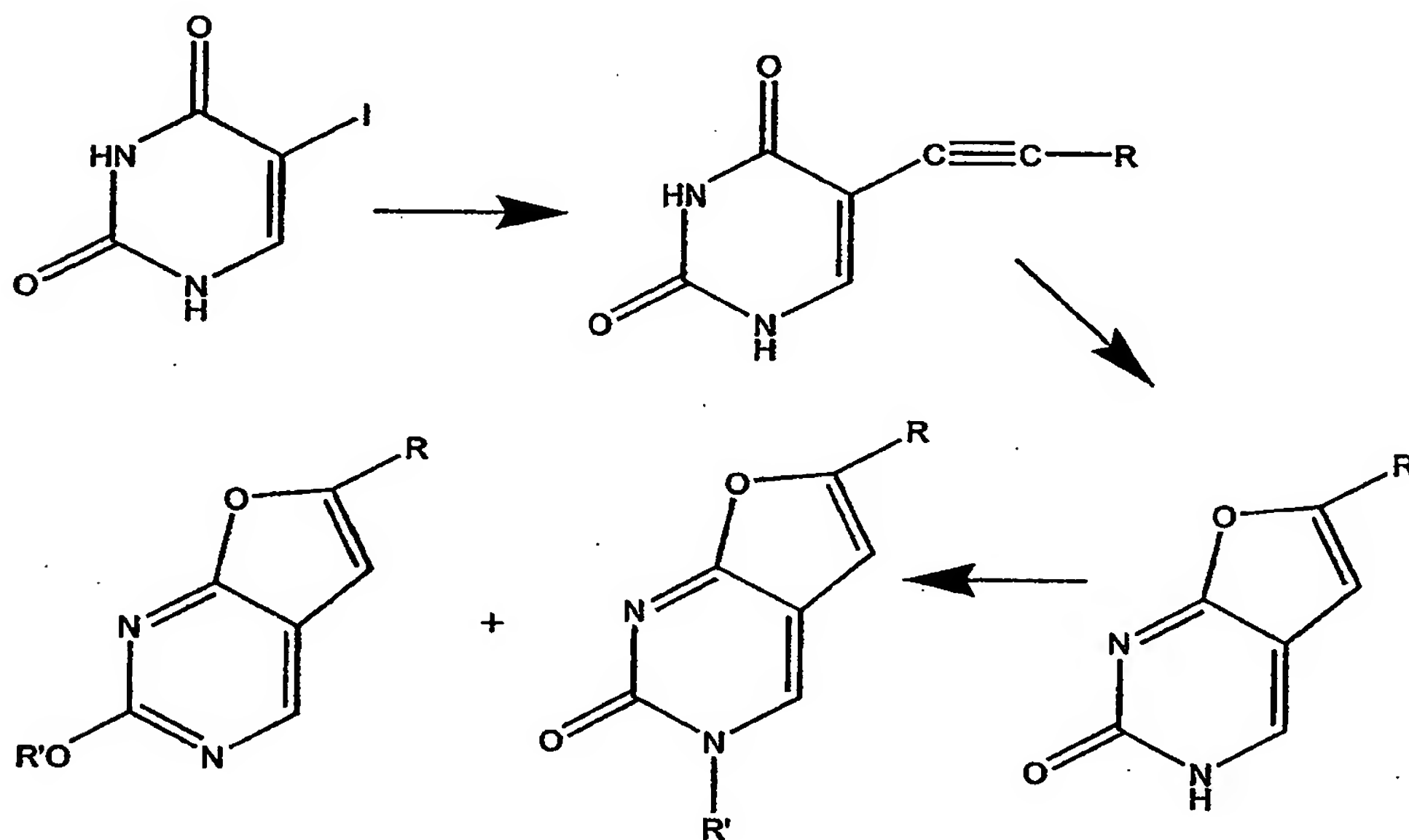
The preferred options recited immediately above with respect to there being a single bond between X and the ring atom to which Q is attached do not necessarily extend to those aspects of the present invention recited below directed, respectively, to: a compound

30 according to the present invention for use in a method of treatment, suitably in the prophylaxis or treatment of a viral infection, preferably a cytomegalovirus infection; a method of prophylaxis or treatment of a viral infection, preferably a cytomegalovirus infection; and use of a compound of the present invention in the manufacture of a

medicament for use in the prophylaxis or treatment of a viral infection, particularly an infection with cytomegalovirus.

According to a further aspect of the present invention there is provided a method for
 5 preparing compounds having Formula I above wherein a 5-halo nucleoside analogue is contacted with a terminal alkyne in the presence of a catalyst. Alternatively 5-alkynyl nucleoside can be cyclised in the presence of a catalyst. Suitably the catalyst is a copper catalyst.

10 Compounds of the present invention may be prepared by a number of methods, which may for example involve a reaction scheme such as:



15 Thus, terminal acetylenes are coupled to 5-iodouracil under Pd catalysed conditions to give intermediate 5-alkynyl compounds that may either be isolated or used in situ. These are cyclised under Cu catalysis to give bicyclic furano pyrimidines that are key synthons. These are alkylated to give mixtures of O and N alkyl products that can be readily separated.

20

The method of separation may include chromatography, precipitation, and crystallisation. The ratios of these products will vary, and need not be 1:1.

Compounds embodying the present invention can show anti-viral activity. In particular, it has surprisingly been found that compounds embodying the present invention can show antiviral activity against for example cytomegalovirus.

5

According to a further aspect of the present invention there is provided a compound according to the present invention for use in a method of treatment, suitably in the prophylaxis or treatment of a viral infection, preferably a cytomegalovirus viral infection.

10 According to a further aspect of the present invention there is provided a method of prophylaxis or treatment of viral infection, preferably a cytomegalovirus viral infection, comprising administration to a patient in need of such treatment an effective dose of a compound according to the present invention.

15 According to a further aspect of the present invention there is provided use of a compound of the present invention in the manufacture of a medicament for use in the prophylaxis or treatment of a viral infection, particularly an infection with cytomegalovirus.

20 According to a further aspect of the present invention there is provided a pharmaceutical composition comprising a compound of the present invention in combination with a pharmaceutically acceptable excipient.

25 According to a further aspect of the present invention there is provided a method of preparing a pharmaceutical composition comprising the step of combining a compound of the present invention with a pharmaceutically acceptable excipient.

The compounds embodying the present invention present a number of advantages over existing agents for HCMV:

- 30
1. A novel non-nucleoside structure and possibly novel mechanism of action.
 2. Antiviral activity at non-cytotoxic concentrations.
 3. A lack of cross resistance with existing nucleoside drugs.

4. Useful physiochemical properties such as high lipophilicity. Lead structures have calculated logP (ClogP) values of Ca. 4-6.

The high lipophilicity of the present compounds may lead to improved *in vivo* dosing, tissue distribution and pharmacokinetics. In a preliminary rodent trial a compound with structure 5 with $R^1 = C_7H_{15}$ and $R^4 =$ cyclopentyl displayed significant bioavailability and half life following i.p. dosing. Moreover at a dose as high as 50mg/kg/day for 10 days no visible *in vivo* toxicity was noted, indicating a promising toxicology profile. Histology also revealed no detectable toxicity against brain, thymus, liver, lungs, kidney, breast, testis, ovum and spleen tissue.

The compounds embodying the present invention can be sufficiently lipophilic to warrant their formulation and use as non-p.o dosage forms including topical, transdermal and ocular formulations. The latter may be of particular value versus HCMV retinitis, common in persons co-infected with HIV. The agents would therein have significant dosing, tissue localisation and toxicology advantage over current agents.

The lack of chirality in structures embodying the present invention distinguishes them from typical nucleoside antivirals with possible costs of goods and ease of synthesis advantage.

The medicaments employed in the present invention can be administered by oral (p.o.) or parenteral (i.p.) routes, including intravenous, intramuscular, intraperitoneal, subcutaneous, transdermal, airway (aerosol), rectal, vaginal and topical (including buccal and sublingual) administration.

For oral administration, the compound of the invention will generally be provided in the form of tablets or capsules, as a powder or granules, or as an aqueous solution or suspension.

Tablets for oral use may include the active ingredient mixed with pharmaceutically acceptable excipients such as inert diluents, disintegrating agents, binding agents, lubricating agents, sweetening agents, flavouring agents, colouring agents and preservatives. Suitable inert diluents include sodium and calcium carbonate, sodium and

calcium phosphate, and lactose, while corn starch and alginic acid are suitable disintegrating agents. Binding agents may include starch and gelatin, while the lubricating agent, if present, will generally be magnesium stearate, stearic acid or talc. If desired, the tablets may be coated with a material such as glyceryl monostearate or glyceryl distearate,
5 to delay absorption in the gastrointestinal tract.

Capsules for oral use include hard gelatin capsules in which the active ingredient is mixed with a solid diluent, and soft gelatin capsules wherein the active ingredient is mixed with water or an oil such as peanut oil, liquid paraffin or olive oil.

10

Formulations for rectal administration may be presented as a suppository with a suitable base comprising for example cocoa butter or a salicylate.

Formulations suitable for vaginal administration may be presented as pessaries, tampons,
15 creams, gels, pastes, foams or spray formulations containing in addition to the active ingredient such carriers as are known in the art to be appropriate.

For intramuscular, intraperitoneal, subcutaneous and intravenous use, the compounds of the invention will generally be provided in sterile aqueous solutions or suspensions,
20 buffered to an appropriate pH and isotonicity. Suitable aqueous vehicles include ringer's solution and isotonic sodium chloride. Aqueous suspensions according to the invention may include suspending agents such as cellulose derivatives, sodium alginate, polyvinylpyrrolidone and gum tragacanth, and a wetting agent such as lecithin. Suitable preservatives for aqueous suspensions include ethyl and n-propyl p-hydroxybenzoate.

25

The compounds of the invention may also be presented as liposome formulations.

In general a suitable dose will be in the range of 0.1 to 300 mg per kilogram body weight of the recipient per day, preferably in the range of 1 to 25 mg per kilogram body weight
30 per day and most preferably in the range 5 to 10 mg per kilogram body weight per day. The desired dose is preferably presented as two, three, four, five or six or more sub-doses administered at appropriate intervals throughout the day. These sub-doses may be

administered in unit dosage forms, for example, containing 10 to 1500 mg, preferably 20 to 1000 mg, and most preferably 50 to 700 mg of active ingredient per unit dosage form.

Embodiments of the present invention will now be described by way of example only.

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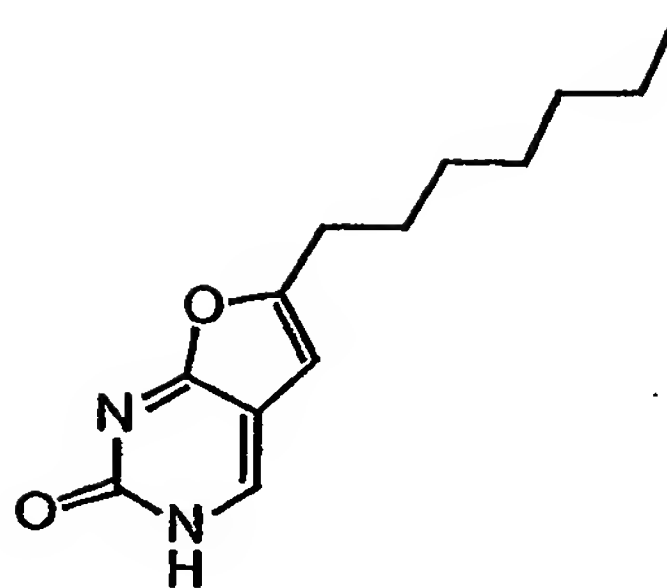
All reagents and solvents were obtained commercially and use without further purification, unless otherwise stated. Reaction progress was monitored by thin-layer chromatography (TLC) on DC-Alufolien 60F₂₅₄ 0.2 mm plates. Compounds were visualised by UV fluorescence (wavelength 365 nm). The reaction mixtures were evaporated in a vacuum rotary evaporator (Büchi *Rotavapor* R-114) using the vacuum of a diaphragm pump. This process is referred to below as "evaporated/removed/distilled *in vacuo*" or "under reduced pressure". Flash column chromatography refers to the technique described by Still (Still *et al* J. Org. Chem. 1978, 43 (14), 2923-2925). The height of the silica gel 60 (220-440 mesh) in all cases was 15 cm. All air and moisture sensitive reactions were carried out under a nitrogen atmosphere in oven-dried glassware. Reaction mixture temperatures were measured externally.

¹H and ¹³C NMR spectra were recorded on a Bruker Avance DPX300 spectrometer at 300 MHz and 75.5 MHz respectively, with the corresponding deuterated solvents noted. The chemical shifts are reported in parts per million relative to the residual non-deuterated solvent peak (δ_{H} CHCl₃ 7.27; δ_{H} [D₅]DMSO 2.50; and δ_{C} CHCl₃ 77.0 and δ_{C} [D₅]DMSO 39.5 central peak). *J* values are given in Hz. The DEPT and NOE techniques were used to assign different carbon atoms. Chemical shifts are reported: value (splitting pattern, number of protons, coupling constant (where applicable), and assignment). Splitting pattern is designated as follows: s, singlet; app d, apparent doublet; d, doublet; dd, double doublet; t, triplet; q, quartet; quin, quintet; sex, sextet; sept, septet; m, multiplet; and br, broad. Elemental analyses were carried out in the Microanalytical Laboratories of the School of Pharmacy, University of London.

30 6-Heptyl-3*H*-furo[2,3-*d*]pyrimidin-2-one (137)

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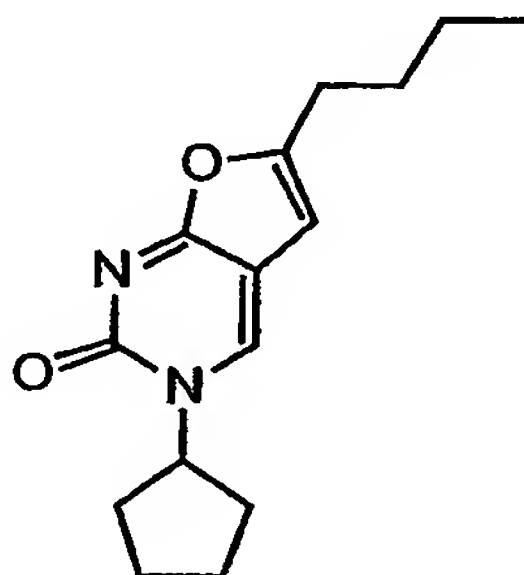
To a stirred solution of 5-Iodo-uracil (3.00 g, 12.60 mmol) in dry dimethylformamide (30 ml) at room temperature and under a nitrogen atmosphere, 1-hexyne (4.20 ml, 37.80 mmol), *tetrakis*(triphenylphosphine)palladium(0) (728 mg, 0.63 mmol), copper (I) iodide (240 mg, 1.26 mmol), and diisopropylethylamine (4.4 ml, 25.20 mmol), were added. The reaction mixture was stirred at room temperature for 19 hours, after which time TLC (chloroform/methanol 95:5) showed complete conversion of the starting material. Copper(I) iodide (240 mg, 1.26 mmol), triethylamine (20 ml) was added to the mixture which was subsequently refluxed for 8 hours. The reaction mixture was then concentrated *in vacuo*, and the product was purified by trituration with methanol, (1.20 g, 41%).

¹H-nmr (d₆-DMSO; 300 MHz): 11.97 (1H, bs, NH), 8.15 (1H, s, H-4) 6.37 (1H, s, H-5), 2.60 (2H, t, J = 7.3 Hz, α-CH₂), 1.62 (2H, m, CH₂), 1.28 (8H, m, 4 x CH₂), 0.86 (3H, t, J = 7.2 Hz, CH₃).

¹³C-nmr unavailable due to solubility problems.

6-Butyl-3-cyclopentyl-3H-furo[2,3-d]pyrimidin-2-one (138) [Cf2158]

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30

To a suspension of 6-Butyl-3H-furo[2,3-d]pyrimidin-2-one (136) (350 mg, 1.82 mmol) in dry DMF (20 ml) under an atmosphere of nitrogen, potassium carbonate (502 mg, 3.64 mmol) and cyclopentyl bromide (0.39 ml, 3.64 mmol) were added. The reaction mixture was stirred at 80 °C for one hour. The solvent was evaporated *in vacuo* and the residue was

dissolved in dichloromethane and extracted with a saturated solution of sodium chloride. The extracts were collected, dried on magnesium sulphate and evaporated to dryness. The crude product was purified by silica column chromatography, using chloroform as eluent, followed by a mixture of chloroform/methanol (97:3). The appropriate fractions were
5 combined and the solvent was removed *in vacuo* to yield the product, which was further purified by trituration with diethyl ether, yielding the pure product (47 mg, 10%) as a white solid. Mp: 130-131 °C.

¹H-nmr (CDCl₃; 300 MHz): 7.84 (1H, s, H-4) 6.13 (1H, s, H-5), 5.29 (1H, m, CH), 2.69 (2H, t, J = 7.2 Hz, α-CH₂), 2.33 (2H, m, cyclopentyl-CH₂), 2.01-1.67 (8H, m, cyclopentyl
10 + CH₂), 1.45 (2H, m, CH₂), 0.99 (3H, t, J = 7.3 Hz, CH₃).

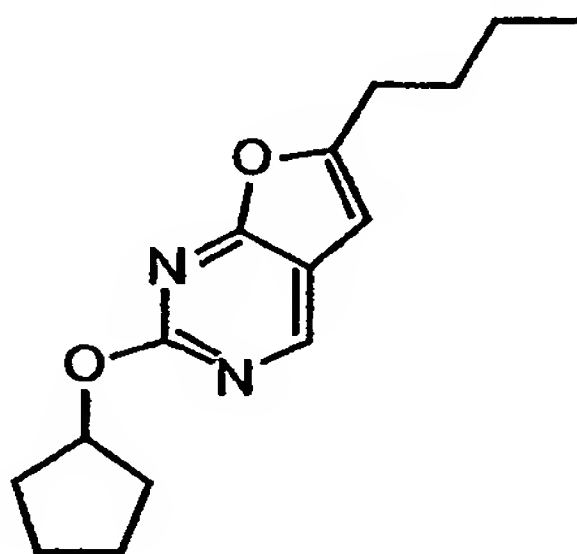
¹³C-nmr (CDCl₃; 75 MHz): 14.1 (CH₃), 22.5, 28.4, 29.3 (3 x CH₂), 24.5, 32.8 (cyclopentyl-CH₂), 59.6 (CH), 98.9 (C-5) 108.2 (C-4a), 135.6 (C-4), 156.2 (C-6), 160.3 (C-2), 171.3 (C-7a).

MS (ES+) m/e 283 (MNa⁺, 100%)

15 Accurate mass: C₁₅H₂₀N₂O₂Na requires 283.1422; found 283.1414.

6-Butyl-2-cyclopentyloxy-furo[2,3-*d*]pyrimidine (139) [Cf2159]

20



25 Also isolated from the above reaction as a white solid (270 mg, 57%). Mp: 69-71 °C.

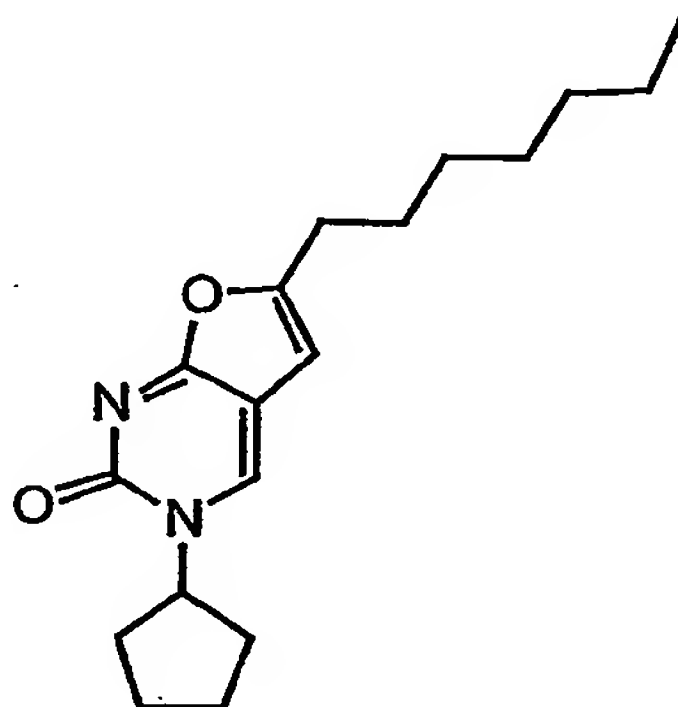
¹H-nmr (CDCl₃; 300 MHz): 8.61 (1H, s, H-4) 6.42 (1H, s, H-5), 5.48 (1H, m, CH), 2.78 (2H, t, J = 7.2 Hz, α-CH₂), 2.06-1.67 (10H, m, cyclopentyl + β-CH₂), 1.46 (2H, m, γ-CH₂), 0.99 (3H, t, J = 7.3 Hz, CH₃).

¹³C-nmr (CDCl₃; 75 MHz): 14.2 (CH₃), 22.6, 28.4, 29.7 (3 x CH₂), 24.2, 33.2 (cyclopentyl-CH₂), 80.4 (CH), 99.5 (C-5) 113.9 (C-4a), 150.9 (C-4), 158.9 (C-6), 162.6 (C-2), 168.8 (C-7a).

30

MS (ES+) m/e 283 (MNa⁺, 100%)

Accurate mass: C₁₅H₂₀N₂O₂Na requires 283.1422; found 283.1428.

6-Heptyl-3-cyclopentyl-3H-furo[2,3-d]pyrimidin-2-one (140) [Cf2160]

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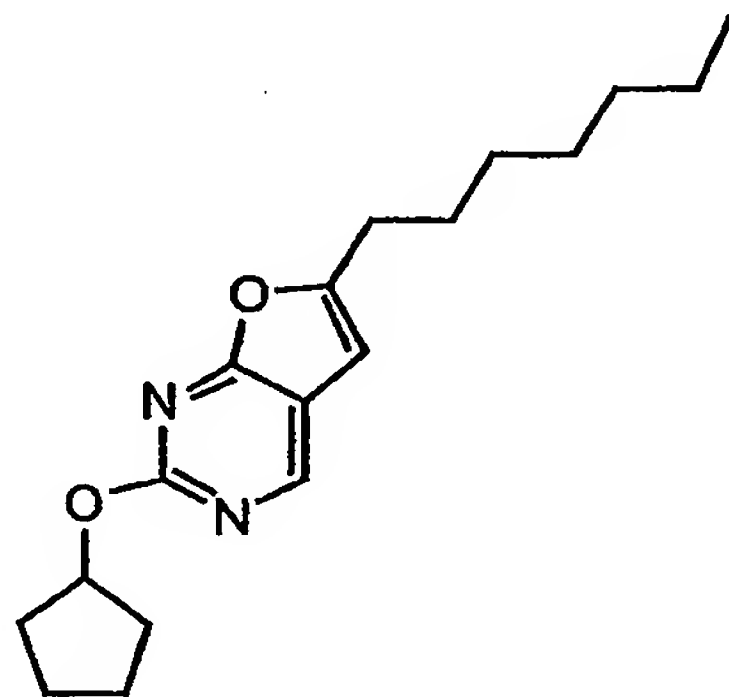
This was synthesised as described for 138 above, using 350 mg of 137 (1.49 mmol) and 0.32 ml of cyclopentyl bromide (2.98 mmol). The product was collected as a white solid (88 mg, 20%). Mp: 142-143 °C.

IR (KBr): 2930.6 (aliphatic), 1677.8 (CO amide).

15 ¹H-nmr (CDCl₃; 300 MHz): 7.80 (1H, s, H-4) 6.09 (1H, s, H-5), 5.25 (1H, m, CH), 2.64 (2H, t, J = 7.4 Hz, α-CH₂), 2.25 (2H, m, cyclopentyl-CH₂), 1.90 -1.67 (8H, m, 4 x CH₂), 1.34 (8H, m, 4 x CH₂), 0.88 (3H, t, J = 6.7 Hz, CH₃). ¹³C-nmr (CDCl₃; 75 MHz): 14.5 (CH₃), 23.0, 27.2, 27.9, 29.3, 29.7, 32.8 (6 x CH₂), 24.5, 33.1 (cyclopentyl-CH₂), 59.7 (CH), 98.9 (C-5) 108.2 (C-4a), 135.7 (C-4), 156.2 (C-6), 160.3 (C-2), 171.6 (C-7a).

20 MS (ES+) m/e 325 (MNa⁺, 100%)

Accurate mass: C₁₈H₂₆N₂O₂Na requires 325.1892; found 325.1883

6-Heptyl-2-cyclopentyloxy-furo[2,3-d]pyrimidine (141) [Cf2161]

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30

Also isolated from the above reaction as a white solid (230 mg, 51%). Mp: 65-67 °C.

IR (KBr): 2954.1 (aliphatic), 1619.6 (C=N).

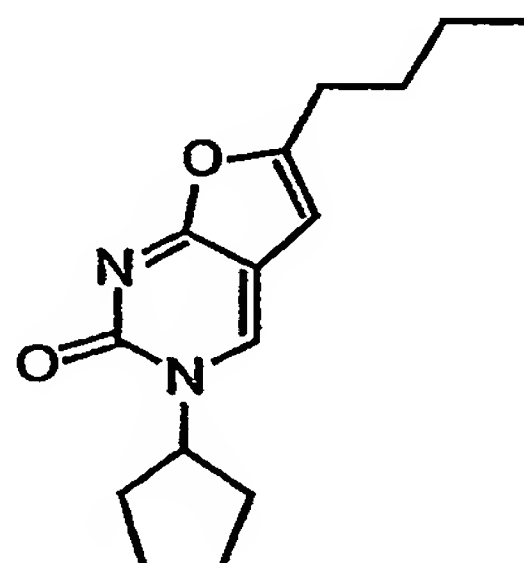
¹H-nmr (CDCl₃; 300 MHz): 8.60 (1H, s, H-4) 6.36 (1H, s, H-5), 5.48 (1H, m, CH), 2.77 (2H, t, J = 7.3 Hz, α-CH₂), 2.08-1.63 (10H, m, cyclopentyl + β-CH₂), 1.42-1.27 (8H, m, 4 x CH₂), 0.91 (3H, t, J = 7.2 Hz, CH₃).

¹³C-nmr (CDCl₃; 75 MHz): 14.5 (CH₃), 23.0, 27.6, 28.8, 29.4, 29.4, 32.1 (6 x CH₂), 24.2, 33.2 (cyclopentyl-CH₂), 80.4 (CH), 99.5 (C-5) 113.9 (C-4a), 150.9 (C-4), 158.9 (C-6), 162.6(C-2), 168.8 (C-7a).

MS (ES+) m/e 325 (MNa⁺, 100%)

Accurate mass: C₁₈H₂₆N₂O₂Na requires 325.1892; found 325.1880

10 **6-Butyl-3-(1-ethyl-propyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one (142) [Cf2194]**



This was synthesised as described for 138 above, using 300 mg of 136 (1.56 mmol) and 0.40 ml of 3-bromopentane (3.12 mmol). The product was collected as a white solid (118 mg, 29%).

IR (KBr): 2958.1 (aliphatic), 1671.9 (CO amide).

¹H-nmr (CDCl₃; 300 MHz): 7.72 (1H, s, H-4) 6.14 (1H, s, H-5), 4.94 (1H, m, CH), 2.68 (2H, t, J = 7.4 Hz, α-CH₂), 1.93-1.66 (6H, m, 3 x CH₂), 1.43 (2H, m, CH₂), 1.00-0.88 (9H, m, 3 x CH₃).

¹³C-nmr (CDCl₃; 75 MHz): 10.7, 14.1 (3 x CH₃), 22.5, 27.9, 28.4, 29.3 (5 x CH₂), 61.3 (CH), 98.9 (C-5) 108.2 (C-4a), 135.4 (C-4), 156.7 (C-6), 160.3 (C-2), 171.4 (C-7a).

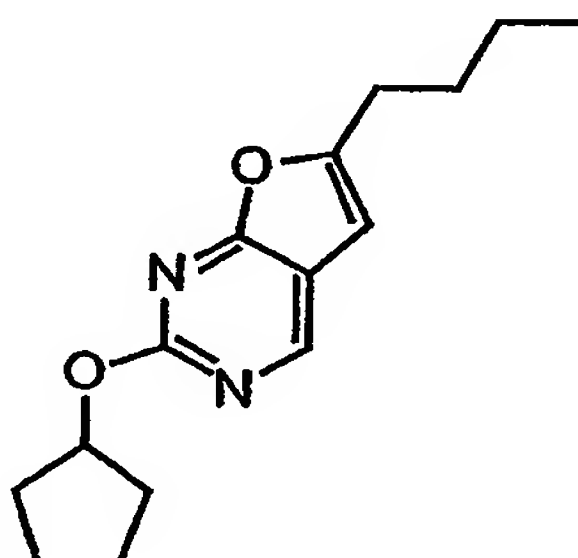
MS (ES+) m/e 285 (MNa⁺, 100%)

Accurate mass: C₁₅H₂₂N₂O₂Na requires 285.1579; found 285.1586

Anal. Calcd for C₁₅H₂₂N₂O₂: C, 68.67%; H, 8.45%; N, 10.68%. Found: C, 68.38%; H, 8.62%; N, 10.89%

6-Butyl-2-(1-ethyl-propoxy)-furo[2,3-*d*]pyrimidine (143) [Cf2193]

5



Also isolated from the above reaction as a white solid (171 mg, 42%).

10 IR (KBr): 2938.4 (aliphatic), 1620.0 (C=N).

¹H-nmr (CDCl₃; 300 MHz): 8.60 (1H, s, H-4) 6.35 (1H, s, H-5), 5.10 (1H, m, CH), 2.77 (2H, t, J = 7.4 Hz, α-CH₂), 1.91-1.70 (6H, m, 3 x CH₂), 1.43 (2H, m, CH₂), 1.00-0.90 (9H, m, 3 x CH₃).

15 ¹³C-nmr (CDCl₃; 75 MHz): 10.0, 14.1 (3 x CH₃), 22.6, 26.5, 28.4, 29.7 (5 x CH₂), 80.0 (CH), 99.5 (C-5) 113.9 (C-4a), 150.9 (C-4), 158.9 (C-6), 162.9 (C-2), 168.8 (C-7a).

MS (ES⁺) m/e 285 (MNa⁺, 100%)

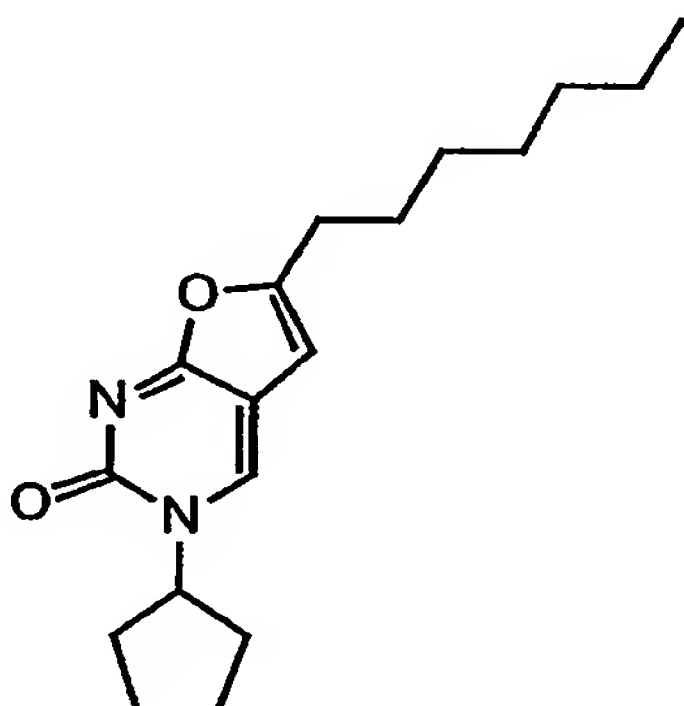
Accurate mass: C₁₅H₂₂N₂O₂Na requires 285.1579; found 285.1575

Anal. Calcd for C₁₅H₂₂N₂O₂: C, 68.67%; H, 8.45%; N, 10.68%. Found: C, 66.97%; H, 8.58%; N, 10.78%

20

6-Heptyl-3-(1-ethyl-propyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one (144) [Cf2190]

25



30

This was synthesised as described for 138 above, using 350 mg of 137 (1.50 mmol) and 0.40 ml of 3-bromopentane (3.00 mmol). The product was collected as a white solid (108 mg, 28%). Mp: 128-130 °C.

¹H-nmr (CDCl₃; 300 MHz): 7.71 (1H, s, H-4) 6.14 (1H, s, H-5), 4.94 (1H, m, CH), 2.68 (2H, t, J = 7.4 Hz, α-CH₂), 1.96-1.67 (6H, m, 3 x CH₂), 1.43-1.32 (8H, m, 4 x CH₂), 0.98-0.89 (9H, m, 3 x CH₃).

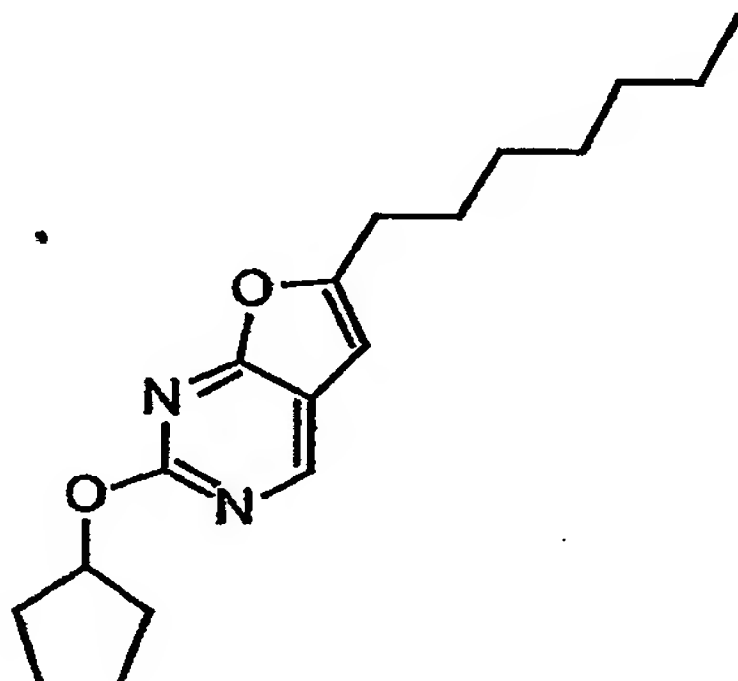
¹³C-nmr (CDCl₃; 75 MHz): 10.7, 14.5 (3 x CH₃), 23.0, 27.2, 27.9, 28.7, 29.3 29.4, 32.1 (7 x CH₂), 61.3 (CH), 98.9 (C-5) 108.2 (C-4a), 135.4 (C-4), 156.7 (C-6), 160.3 (C-2), 171.4 (C-7a).

MS (ES+) m/e 327 (MNa⁺, 100%), 305 (MH⁺) (50%)

Accurate mass: C₁₈H₂₈N₂O₂Na requires 327.2048; found 327.2038

10 **6-Heptyl-2-(1-ethyl-propoxy)-furo[2,3-*d*]pyrimidine (145) [Cf2189]**

15



20 Also isolated from the above reaction as a white solid (272 mg, 70%). Mp: 70-71 °C.

¹H-nmr (CDCl₃; 300 MHz): 8.48 (1H, s, H-4) 6.24 (1H, s, H-5), 5.01 (1H, m, CH), 2.65 (2H, t, J = 7.3 Hz, α-CH₂), 1.72-1.60 (6H, m, 3 x CH₂), 1.60-1.20 (8H, m, 4 x CH₂), 0.91-0.77 (9H, m, 3 x CH₃).

¹³C-nmr (CDCl₃; 75 MHz): 9.9, 14.4 (3 x CH₃), 23.0, 26.4, 27.6, 28.7, 29.3, 29.4, 32.0 (7 x CH₂), 80.0 (CH), 99.5 (C-5) 113.9 (C-4a), 150.9 (C-4), 158.8 (C-6), 162.9 (C-2), 168.8 (C-7a).

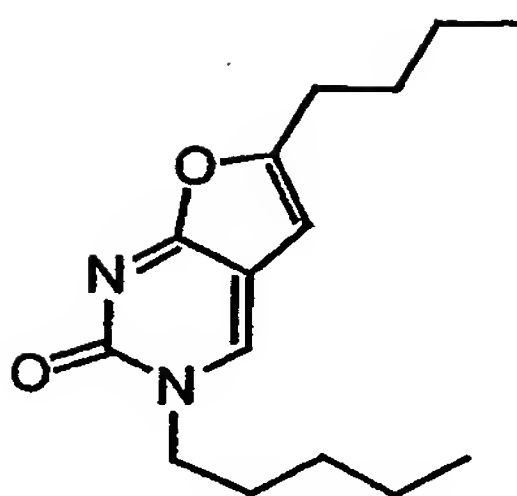
MS (ES+) m/e 327 (MNa⁺, 100%)

Accurate mass: C₁₈H₂₈N₂O₂Na requires 327.2048; found 327.2053

30 **6-Butyl-3-pentyl-3*H*-furo[2,3-*d*]pyrimidin-2-one (146) [Cf2195]**

21

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This was synthesised as described for 138 above, using 250 mg of 136 (1.30 mmol) and 515 mg of 1-Iodopentane (2.60 mmol). The product was collected as a white solid (133 mg, 40%). Mp: 139-141 °C.

¹H-nmr (CDCl₃; 300 MHz): 7.77 (1H, s, H-4) 6.07 (1H, s, H-5), 3.96 (2H, t, J = 7.4 Hz, N-CH₂), 2.61 (2H, t, J = 7.4 Hz, α-CH₂), 1.94-1.58 (4H, m, 3 x CH₂), 1.43-1.24 (6H, m, 3 x CH₂), 0.93-0.84 (6H, m, 2 x CH₃).

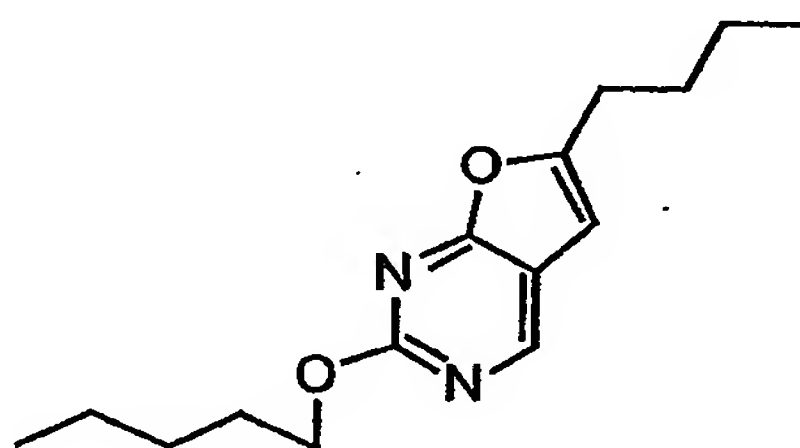
¹³C-nmr (CDCl₃; 75 MHz): 14.1, 14.3 (2 x CH₃), 22.5, 22.7, 28.4, 29.0, 29.2, 29.3 (6 x CH₂), 52.6 (N-CH₂), 98.8 (C-5) 108.1 (C-4a), 139.1 (C-4), 155.8 (C-6), 160.2 (C-2), 172.3 (C-7a).

MS (ES+) m/e 285 (MNa⁺, 100%)

Accurate mass: C₁₅H₂₂N₂O₂Na requires 285.1579; found 285.1568

20 6-Butyl-2-pentyloxy-furo[2,3-d]pyrimidine (147) [Cf 2327]

25



Also isolated from the above reaction as a white solid (62 mg, 20%). Mp: 51-52 °C.

¹H-nmr (CDCl₃; 300 MHz): 8.49 (1H, s, H-4) 6.25 (1H, s, H-5), 4.32 (2H, t, J = 6.6 Hz, O-CH₂), 2.64 (2H, t, J = 7.3 Hz, α-CH₂), 1.85-1.66 (4H, m, 2 x CH₂), 1.43 (6H, m, 3 x CH₂), 0.92-0.73 (6H, m, 2 x CH₃).

¹³C-nmr (CDCl₃; 75 MHz): 14.1, 14.4 (2 x CH₃), 22.5, 22.8, 28.4, 28.5, 28.9, 29.6 (7 x CH₂), 68.3 (O-CH₂), 99.5 (C-5) 114.1 (C-4a), 150.9 (C-4), 159.0 (C-6), 162.8 (C-2), 168.8(C-7a).

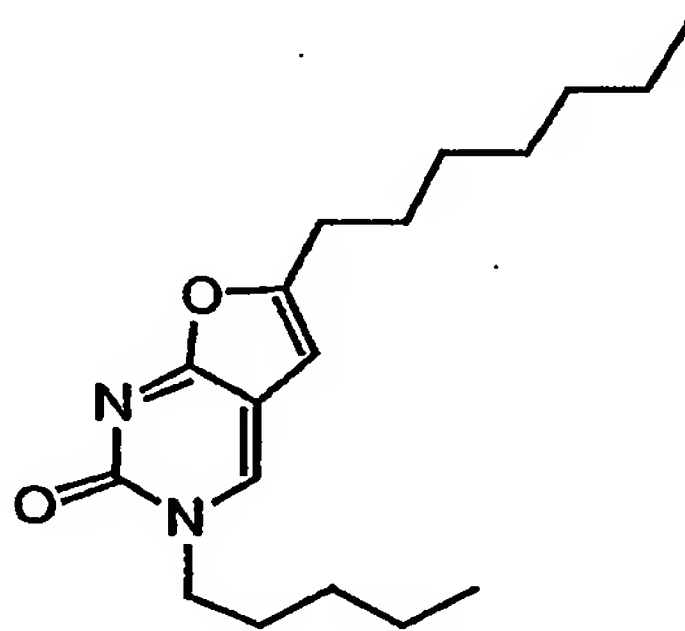
MS (ES+) m/e 285 (MNa⁺, 100%)

Accurate mass: C₁₅H₂₂N₂O₂Na requires 285.1579; found 285.1584

6-Heptyl-3-pentyl-3H-furo[2,3-d]pyrimidin-2-one (148) [Cf2192]

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10



This was synthesised as described for 138 above, using 350 mg of 137 (1.50 mmol) and
15 594 mg of 1-Iodopentane (3.00 mmol). The product was collected as a white solid (207
mg, 45%). Mp: 161-162 °C.

IR (KBr): 2922.1 (aliphatic), 1678.3 (CO amide).

¹H-nmr (CDCl₃; 300 MHz): 7.87 (1H, s, H-4) 6.18 (1H, s, H-5), 4.07 (2H, t, J = 7.4 Hz, N-
CH₂), 2.71 (2H, t, J = 7.3 Hz, α-CH₂), 1.93-1.71 (4H, m, 2 x CH₂), 1.42 (12H, m, 6 x
20 CH₂), 0.98 (6H, m, 2 x CH₃).

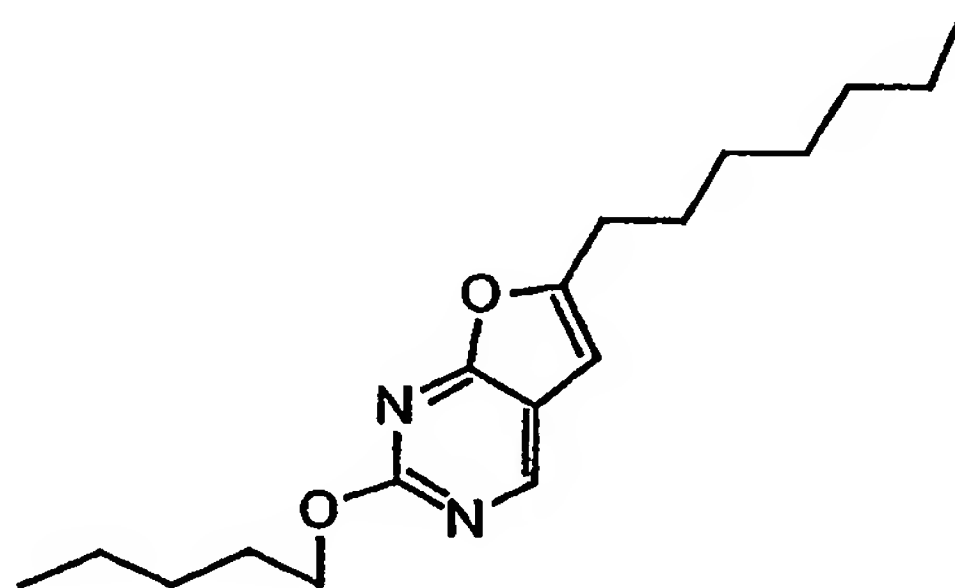
¹³C-nmr (CDCl₃; 75 MHz): 14.3, 14.9 (2 x CH₃), 22.7, 23.0, 27.2, 28.7, 29.1, 29.3, 29.3
29.4 32.1 (9 x CH₂), 52.6 (N-CH₂), 98.8 (C-5) 108.1 (C-4a), 139.1 (C-4), 155.8 (C-6),
160.3 (C-2), 172.3 (C-7a).

MS (ES+) m/e 327 (MNa⁺, 100%)

25 Accurate mass: C₁₈H₂₈N₂O₂Na requires 327.2048; found 327.2042

6-Heptyl-2-pentyloxy-furo[2,3-d]pyrimidine (149) [Cf2191]

30



Also isolated from the above reaction as a white solid (141 mg, 31%). Mp: 48-49 °C.

IR (KBr): 2933.0 (aliphatic), 1618.0 (C=N).

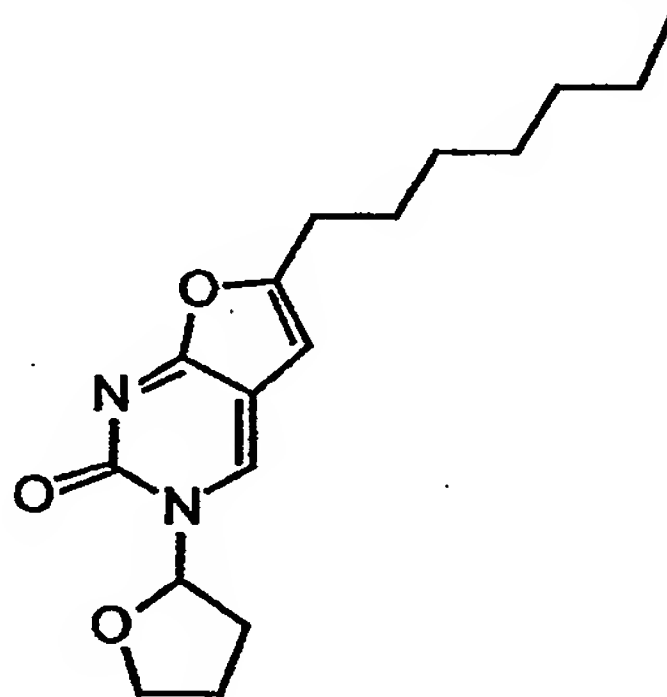
¹H-nmr (CDCl₃; 300 MHz): 8.50 (1H, s, H-4) 6.25 (1H, s, H-5), 4.30 (2H, t, J = 6.7 Hz, O-CH₂), 2.65 (2H, t, J = 7.4 Hz, α-CH₂), 1.80-1.60 (4H, m, 2 x CH₂), 1.44-1.19 (12H, m, 6 x CH₂), 0.86-0.77 (6H, m, 2 x CH₃).

¹³C-nmr (CDCl₃; 75 MHz): 14.4 (2 x CH₃), 22.8, 23.0, 27.6, 28.5, 28.7, 28.9, 29.3, 29.4, 32.0 (9 x CH₂), 68.3 (O-CH₂), 99.5 (C-5) 114.1 (C-4a), 150.8 (C-4), 159.0 (C-6), 162.8 (C-2), 172.3 (C-7a).

MS (ES+) m/e 327 (MNa⁺, 100%)

10 Accurate mass: C₁₈H₂₈N₂O₂Na requires 327.2048; found 327.2050

6-Heptyl-3-(tetrahydro-furan-2-yl)-3H-furo[2,3-d]pyrimidin-2-one (154) [Cf2196]



To a suspension of 6-heptyl-3H-furo[2,3-d]pyrimidin-2-one (137) (288 mg, 1.23 mmol) in dry DMF (10 ml) 2-tert-Butoxytetrahydrofuran (709 mg, 4.92 mmol) was added. The reaction mixture was stirred at 150°C for 10 hours. The solvent was evaporated *in vacuo* and the residue was dissolved in dichloromethane and purified by silica column chromatography, using chloroform as eluent, followed by a mixture of chloroform/methanol (98:2). The appropriate fractions were combined and the solvent was removed *in vacuo* to yield the product, which was further purified by trituration with diethyl ether, yielding the pure product (150 mg mg, 40%) as a white solid.

IR (KBr): 2927.1 (aliphatic), 1671.9 (CO amide), 1084.0 (C-O).

30 ¹H-nmr (CDCl₃; 300 MHz): 7.93 (1H, s, H-4) 6.09 (2H, m, H-5 and H-1'), 4.26 and 4.04 (2H, m, H-5'), 2.60 (2H, t, J = 7.4 Hz, α-CH₂), 2.56 (2H, m, H-2'_a), 2.18 and 2.00 (2H, m, H-3') 1.99 (2H, m, H-2'_b), 1.59 (2H, m, CH₂), 1.30-1.23 (8H, m, 4 x CH₂), 0.83 (3H, t, J = 6.7 Hz, CH₃).

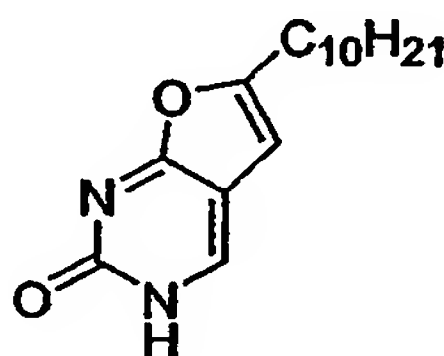
^{13}C -nmr (CDCl_3 ; 75 MHz): 14.5 (CH_3), 23.0, 23.7, 27.2, 28.7, 29.3, 29.4, 32.1, 33.8 (8 x CH_2), 71.1 (C-5'), 90.2 (C-1'), 99.1 (C-5), 107.6 (C-4a), 134.2 (C-4), 155.2 (C-6), 160.2 (C-2), 171.3 (C-7a).

MS (ES+) m/e 327 (MNa^+ , 100%)

5 Accurate mass: $\text{C}_{17}\text{H}_{24}\text{N}_2\text{O}_3\text{Na}$ requires 327.1685; found 327.1678

Anal. Calcd for $\text{C}_{17}\text{H}_{24}\text{N}_2\text{O}_3$: C, 67.08%; H, 7.95%; N, 9.20%. Found: C, 67.01%; H, 8.14%; N, 9.26%

6-Decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one 26

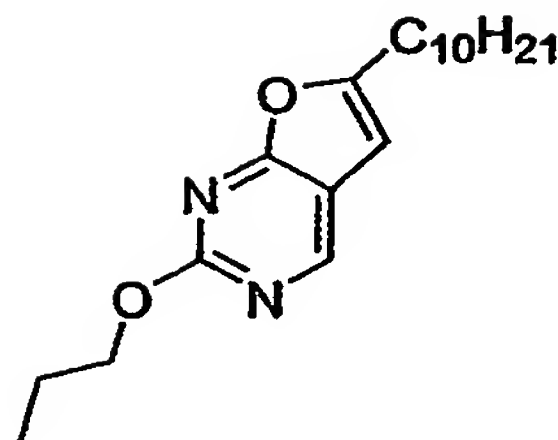


10

To a dry DMF (50 mL) solution of 5-iodouracil 23 (5.00 g, 21 mmol), tetrakis(triphenylphosphine)palladium(0) (1.00 g, 0.87 mmol, 0.04 equiv.) and copper iodide (0.80 g, 4.2 mmol, 0.2 equiv.) under a nitrogen atmosphere was added dry DIPEA (7.3 mL, 5.42 g, 42 mmol, 2 equiv.) and 1-dodecyne 24 (13.5 mL, 10.48 g, 63 mmol, 3 equiv.) via syringe with stirring. The initially opaque yellow solution proceeded to change colour on stirring at room temperature to a clear dark yellow solution, and eventually an opaque dark green suspension formed after a couple of hours. The suspension was allowed to react at RT with stirring for 18 h. TLC analysis of the resulting mixture indicated that most of the starting material had reacted, and the presence of a blue fluorescent spot was clearly observed. Dry triethylamine (25 mL) and a further addition of copper iodide (0.80 g) was then made to the suspension, and the resultant reaction mixture heated to 80 °C for 6 h with stirring under N_2 . The suspension was allowed to cool to RT overnight with stirring. The resultant precipitate was collected by suction filtration, and washed consecutively with methanol and DCM. The collected solid was triturated in hot methanol to yield *the title compound* 26 as a white insoluble solid of weight 3.79 g (65 % from 23).

6-Decyl-2-propoxy-furo[2,3-*d*]pyrimidine Cf2303

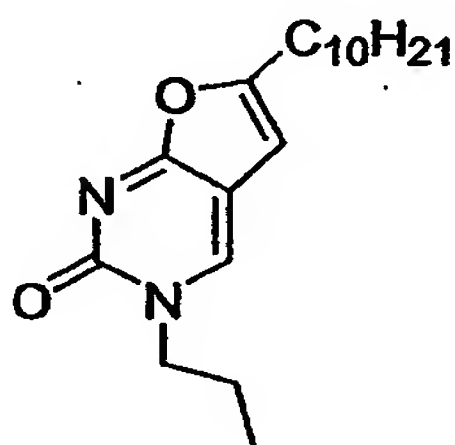
25



26 (0.30 g, 1.086 mmol), potassium carbonate (0.30 g, 2.17 mmol, 2 equiv) and 1-iodopropane (30, 0.22 mL, 2.17 mmol, 2 equiv.) were suspended in dry DMF (5 mL) under N₂, and the reaction mixture heated to 100 °C with stirring overnight. The solvent was then removed *in vacuo* at 80 °C, and the crude mixture purified by flash chromatography in a 0-5 % methanol/DCM eluent gradient to yield 31 (102 mg, 29 %), *the title compound*, as a white solid. ¹H NMR (CDCl₃) δ 8.48 (s, 1H, 4-H), 6.49 (s, 1H, 5-H), 4.44 (t, *J* = 6.7 Hz, 2H, O-CH₂-), 2.81 (t, *J* = 7.6 Hz, 2H, 1'-CH₂), 1.95 (app sex, *J* = 7.1 Hz, 2H, CH₂), 1.82 (m, *J* = 6.6 Hz, 2H, CH₂), 1.43 (m, 14H, CH₂), 1.15 (t, *J* = 7.4 Hz, 3H, O-CH₂CH₃), 0.97 (t, *J* = 7.0 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 168.9 (7a-C), 162.9 (2-C), 159.1 (6-C), 150.9 (4-CH), 114.2 (4a-C), 99.5 (5-CH), 69.9 (O-CH₂), 32.3 (1'-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.5 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 23.1 (CH₂), 22.6 (CH₂), 14.5 (O-CH₂CH₃), 10.9 (-CH₂CH₃).

15

6-Decyl-3-propyl-3H-furo[2,3-d]pyrimidin-2-one Cf2304

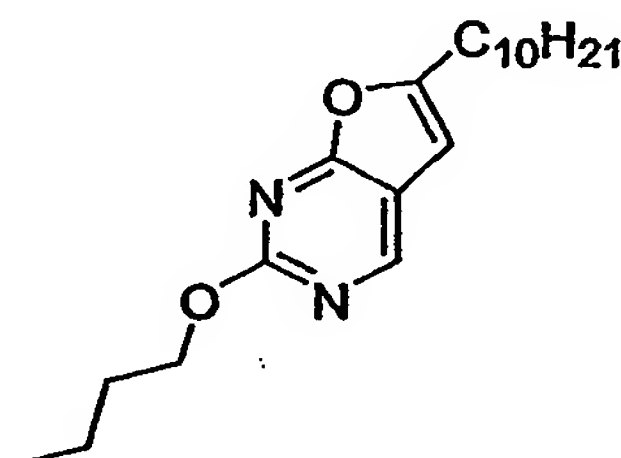


Also isolated from the mix was 191 mg of *the title compound* 32 (55 % yield) as a white solid. ¹H NMR (CDCl₃) δ 7.74(s, 1H, 4-H), 6.13(s, 1H, 5-H), 4.01 (t, *J* = 7.3 Hz, 2H, N-CH₂-), 2.70 (t, *J* = 7.7 Hz, 2H, 1'-CH₂), 1.89 (app sex, *J* = 7.4 Hz, 2H, CH₂), 1.89 (m, *J* = 7.4 Hz, 2H, CH₂), 1.70 (m, *J* = 7.4 Hz, 2H, CH₂), 1.38 (m, 14H, CH₂), 1.04 (t, *J* = 7.4 Hz, 3H, N-CH₂CH₃), 0.96 (t, *J* = 7.0 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 169.9 (7a-C), 160.4 (2-C), 156.1 (6-C), 138.9 (4-CH), 108.6 (4a-C), 98.6 (5-CH), 54.2 (N-CH₂), 32.3

(1'-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.5 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 23.1 (CH₂), 22.8 (CH₂), 14.5 (O-CH₂CH₃), 11.5 (-CH₂CH₃).

2-Butoxy-6-decyl-furo[2,3-*d*]pyrimidine Cf2305

5

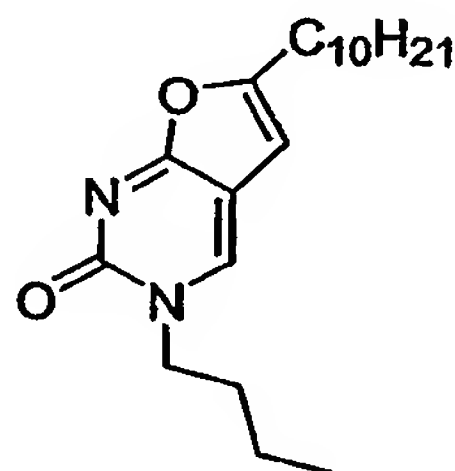


26 (0.30 g, 1.086 mmol), potassium carbonate (0.30 g, 2.17 mmol, 2 equiv) and 1-iodobutane 33 (0.25 mL, 2.17 mmol, 2 equiv.) were suspended in dry DMF (5 mL) under N₂, and the reaction mixture heated to 100 °C with stirring overnight. The solvent was then removed *in vacuo* at 80 °C, and the crude mixture purified by flash chromatography in a 0-5 % methanol/DCM eluent gradient to yield 34 (114 mg, 32 %) as white solid.

¹H NMR (CDCl₃) δ 8.61 (s, 1H, 4-H), 6.36 (s, 1H, 5-H), 4.36 (t, *J* = 6.7 Hz, 2H, O-CH₂-), 2.75 (t, *J* = 7.6 Hz, 2H, 1'-CH₂), 1.90-1.74 (m, 4H, CH₂), 1.54 (m, 2H, CH₂), 1.29 (m, 14H, CH₂), 1.00 (t, *J* = 6.8 Hz, 3H, O-CH₂CH₃), 0.91 (t, *J* = 7.0 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 168.9 (7a-C), 162.9 (2-C), 159.1 (6-C), 150.9 (4-CH), 113.9 (4a-C), 99.5 (5-CH), 68.1 (O-CH₂), 32.3 (1'-CH₂), 31.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.5 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 23.1 (CH₂), 19.6 (CH₂), 14.5 (O-CH₂CH₃), 14.2 (-CH₂CH₃).

20

3-Butyl-6-decyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2306

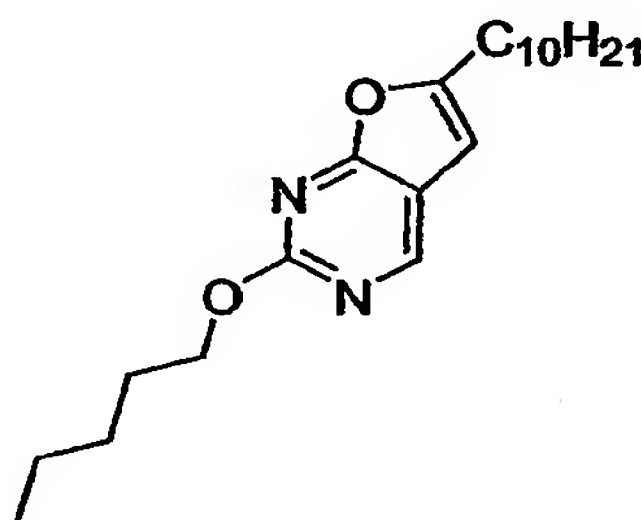


Also isolated from the mixture was *the title compound 35* (205 mg, 57 % yield) as a white solid.

¹H NMR (CDCl₃) δ 7.76 (s, 1H, 4-H), 6.04 (s, 1H, 5-H), 3.93 (t, *J* = 7.4 Hz, 2H, N-CH₂-), 2.56 (t, *J* = 7.4 Hz, 2H, 1'-CH₂), 1.71 (m, 2H, CH₂), 1.60 (m, 2H, CH₂), 1.36-1.18 (m, 16H, CH₂), 0.88 (t, *J* = 7.2 Hz, 3H, N-CH₂-CH₃), 0.80 (t, *J* = 6.5 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 172.3 (7a-C), 160.3 (2-C), 155.9 (6-C), 139.2 (4-CH), 108.2 (4a-C), 98.8 (5-CH), 52.4 (N-CH₂-), 32.3 (1'-CH₂), 31.6 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 23.1 (CH₂), 20.2 (CH₂), 14.5 (O-CH₂CH₃), 14.1 (-CH₂CH₃).

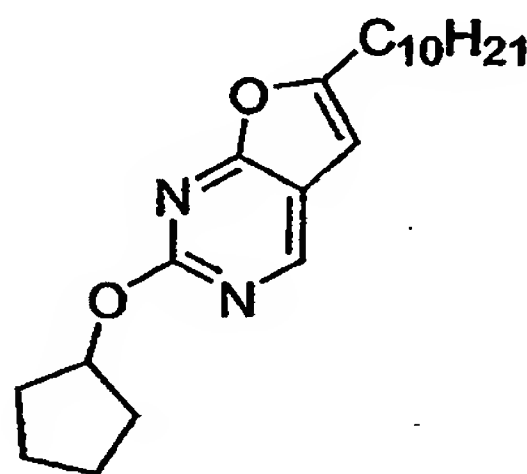
10

6-Decyl-2-pentyloxy-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2247

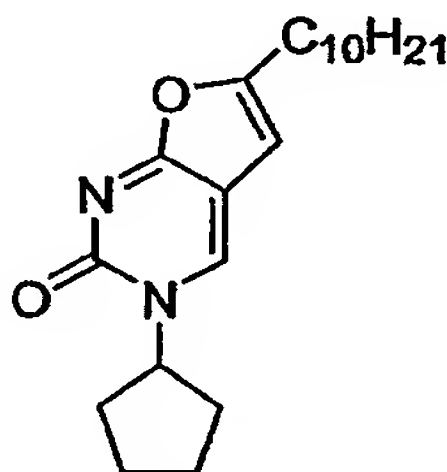


15 6-Decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one 26 (200 mg, 0.72 mmol), potassium carbonate (199 mg, 1.44 mmol, 2 equiv.) and 1-iodopentane 36 (0.2 mL, 2 equiv.) were suspended in dry DMF (8 mL) under N₂, and the suspension heated to 120 °C with stirring for 4 h. The solvent was removed *in vacuo* at 80 °C, with subsequent additions and removals of toluene (2 mL) to eliminate DMF traces. The crude residue was purified by
20 flash column chromatography to yield 37 (88 mg, 35 %) as a cream solid.

¹H NMR (CDCl₃) δ 8.57 (s, 1H, 4-H), 6.33 (s, 1H, 5-H), 4.38 (t, 2H, *J* = 6.7 Hz, 1'-CH₂), 2.73 (t, 2H, *J* = 7.4 Hz, α-CH₂), 1.84 (qt, 2H, *J* = 6.8 Hz, CH₂), 1.74 (m, 2H, CH₂), 1.50-1.26 (m, 18H, 9 x CH₂), 0.94-0.85 (m, 6H, 2 x CH₃); ¹³C NMR (CDCl₃) δ 168.9 (7a-C), 162.9 (2-C), 159.1 (6-C), 150.9 (4a-C), 99.5 (5-CH), 68.4 (1'-CH₂), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 28.9 (CH₂), 28.8 (CH₂), 28.7 (CH₂), 28.5 (CH₂), 27.6 (CH₂), 23.1 (CH₂), 22.9 (CH₂), 14.5 (CH₃), 14.4 (CH₃). Elemental analysis calcd for C₂₁H₃₄N₂O₂ (346.5): C 72.79, N 8.08, H 9.89; found C 73.68, N 10.03, H 8.06.

2-Cyclopentyloxy-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2250

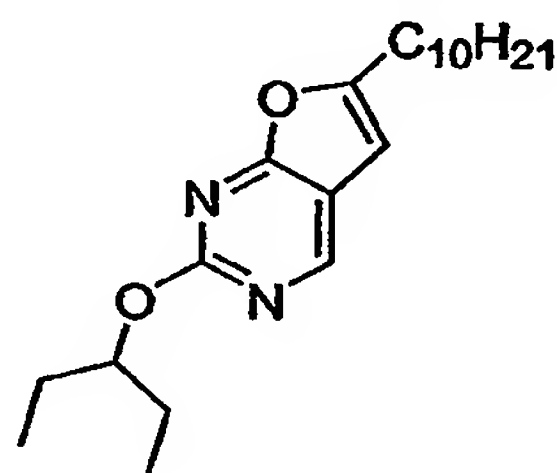
- 5 26 (1.00 g, 3.62 mmol), potassium carbonate (1.00 g, 7.24 mmol, 2 equiv.) and cyclopentyl bromide 39 (0.23 mL, 2.17 mmol, 2 equiv.) were suspended in dry DMF (15 mL) under N₂, and the mixture stirred at RT for 6 h. The grey/green suspension was then heated to 120 °C for 5 h, then allowed to cool with stirring overnight. The solvent was removed *in vacuo* at 80 °C. The crude residue was purified by flash column chromatography in 0-1%
 10 MeOH/DCM eluent gradient to yield 40 as a white solid (0.87 g, 70 % yield). ¹H NMR (CDCl₃) δ 8.48 (b, 1H, 4-H), 6.23 (s, 1H, 5-H), 5.36 (m, 1H, 1'-H), 2.65 (t, 2H, *J* = 7.5 Hz, α-CH₂), 1.93-1.52 (m, 10H, 5 x CH₂), 1.25-1.17 (m, 14H, 7 x CH₂), 0.78 (t, 3H, *J* = 6.5 Hz, CH₃); ¹³C NMR (CDCl₃) δ = 168.8 (7a-C), 162.5 (2-C), 158.9 (6-C), 150.9 (4-CH), 113.9 (4a-C), 99.5 (5-CH), 80.3 (1'-CH), 33.1 (2 x CH₂), 32.3 (CH₂), 30.0 (CH₂), 29.9
 15 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 28.7 (CH₂), 27.6 (2 x CH₂), 24.2 (CH₂), 23.1 (CH₂), 14.5 (CH₃). Elemental analysis calculated for C₂₁H₃₂N₂O₂ (344.5): C 73.22, N 8.13, H 9.36; found C 73.85, N 8.61, H 9.84.

3-Cyclopentyl-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one Cf2251

Also isolated from the above reaction was *the title compound* 41 (0.18 g, 14 %) as a yellow solid.

^1H NMR (CDCl_3) δ 7.79 (s, 1H, 4-H), 6.05 (s, 1H, 5-H), 5.16 (m, 1H, 1'-H), 2.56 (t, 2H, J = 7.5 Hz, $\alpha\text{-CH}_2$), 2.16 (m, 2H, CH_2), 1.82-1.55 (m, 8H, 4 x CH_2), 1.25-1.19 (m, 14H, 7 x CH_2), 0.80 (t, 3H, J = 6.4 Hz, CH_3); ^{13}C NMR (CDCl_3) δ 171.6 (7a-C), 160.3 (6-C), 156.2 (2-C), 135.8 (4-CH), 108.3 (4a-C), 99.0 (5-CH), 59.7 (1'- CH_2), 32.8 (2 x CH_2), 32.3 (CH₂), 30.0 (CH₂), 29.7 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.2 (2 x CH_2), 24.5 (CH₂), 23.1 (CH₂), 14.5 (CH₃). Elemental analysis calculated for $\text{C}_{21}\text{H}_{32}\text{N}_2\text{O}_2$ (344.5): C 73.22, N 8.13, H 9.36; found C 72.83, N 8.18, H 9.84.

2-(1'-Ethyl-propyloxy)-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2252

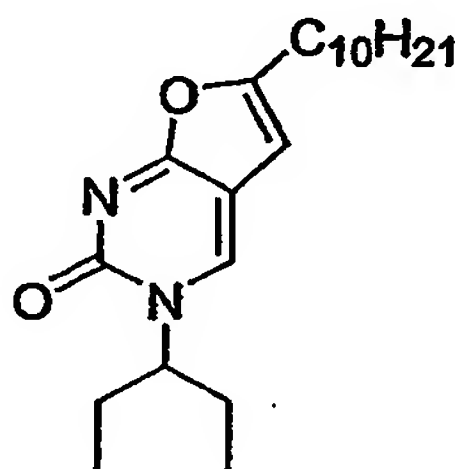


10

26 (0.50 g, 1.81 mmol), potassium carbonate (0.50 g, 3.62 mmol, 2 equiv) and 3-bromopentane **42** (0.45 mL, 3.62 mmol, 2 equiv.) were suspended in dry DMF (15 mL) under N_2 , and the reaction mixture heated to 120 °C with stirring for 150 min. The dark suspension was allowed to cool to RT over 2 h, and then the solvent was removed under reduced pressure at 80 °C. The residue was then subjected to flash column chromatography purification in a 0-5 % MeOH/DCM eluent gradient to yield **43** as a yellow oil of weight 0.27 g (43 % yield).

^1H NMR (CDCl_3) δ = 8.44 (s, 1H, 4-H), 6.20 (s, 1H, 5-H), 4.96 (qt, 1H, J = 6.0 Hz, 1'-H), 2.60 (t, 2H, J = 7.5 Hz, $\alpha\text{-CH}_2$), 1.68-1.55 (m, 6H, 3 x CH_2), 1.24-1.13 (m, 12H, 6 x CH_2), 0.84 (t, 6H, J = 7.4 Hz, 2 x CH_3), 0.74 (t, 3H, J = 6.9 Hz, CH_3); ^{13}C NMR (CDCl_3) δ = 168.8 (7a-C), 162.9 (6-C), 158.7 (2-C), 150.9 (4-CH), 113.9 (4a-C), 99.5 (5-CH), 79.9 (1'-CH), 32.2 (CH_2), 29.9 (CH_2), 29.7 (CH_2), 29.6 (CH_2), 29.4 (CH_2), 28.7 (CH_2), 27.6 (CH_2), 26.7 (2 x CH_2), 26.4 (CH_2), 23.0 (CH_2), 14.4 (CH_3), 9.9 (2 x CH_3). Elemental analysis calcd for $\text{C}_{21}\text{H}_{34}\text{N}_2\text{O}_2$ (346.5): C 72.79, N 8.08, H 9.89; found C 73.12, N 8.56, H 9.93.

25

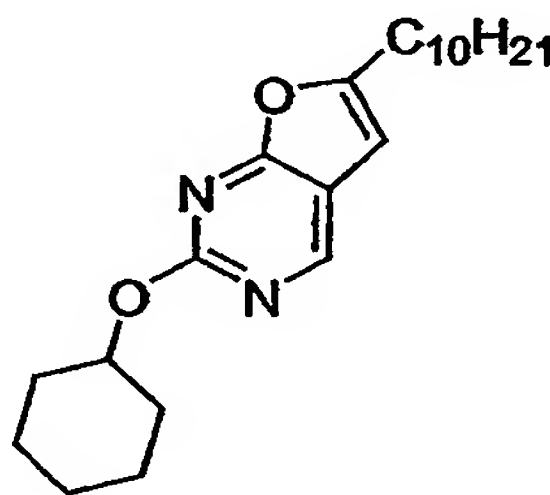
3-(1'-Ethyl-propyl)-6-decyl-2,3-dihydrofuro[2,3-d]pyrimidin-2-one Cf2253

Also isolated from the above reaction was *the title compound 44* as a white solid (0.168 g,
5 27 %).

^1H NMR (CDCl_3) δ = 7.72 (s, 1H, 4-H), 6.15 (s, 1H, 5-H), 4.94 (b, 1H, 1'-H), 2.67 (t, 2H, J = 7.4 Hz, $\alpha\text{-CH}_2$), 1.87 (m, 2H, CH_2), 1.71 (m, 4H, 2 x CH_2), 1.36-1.23 (m, 14H, 7 x CH_2), 0.91 (t, 9H, J = 6.8 Hz, 3 x CH_3); ^{13}C NMR (CDCl_3) δ = 171.2 (7a-C), 160.4 (6-C), 156.7 (2-C), 135.5 (4-CH), 108.3 (4a-C), 98.9 (5-CH), 32.3 (CH_2), 30.0 (CH_2), 29.9 (CH_2),
10 29.7 (2 x CH_2), 29.5 (CH_2), 28.7 (CH_2), 28.0 (CH_2), 27.2 (CH_2), 23.1 (CH_2), 14.5 (CH_3), 10.8 (2 x CH_3). Elemental analysis calculated for $\text{C}_{21}\text{H}_{34}\text{N}_2\text{O}_2$ (346.5): C 72.79, N 8.08, H 9.89; found C 72.65, N 8.16, H 10.08.

2-Cyclohexyloxy-6-decyl-2,3-dihydrofuro[2,3-d]pyrimidine Cf2294

15

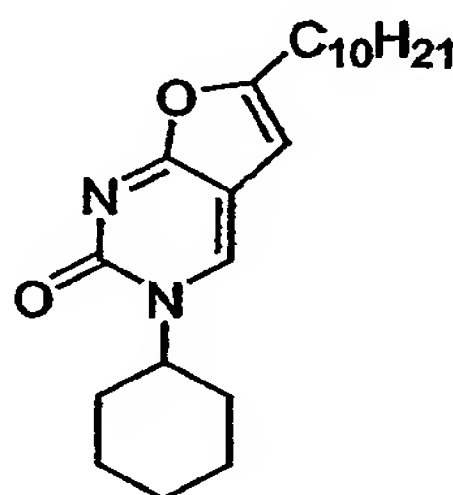


26 (300 mg, 1.086 mmol) and potassium carbonate (299 mg, 2.17 mmol, 2 equiv.) were
20 suspended in dry DMF (10 mL) and cyclohexyl bromide 45 (0.54 mL, 2.17 mmol, 2 equiv.) added *via* syringe under N_2 . The suspension was heated with stirring to 100 °C overnight. The solvent was removed *in vacuo* at 80 °C. The residue was suspended in DCM and washed with water. The organic layer was dried over MgSO_4 , the solvent distilled *in vacuo* and the resultant residue purified by flash column chromatography in a 0-

2 % MeOH/DCM eluent gradient to yield **46** as a clear colourless waxy solid (78 mg, 20 % yield).

¹H NMR (CDCl₃) δ = 8.68 (s, 1H, 4-H), 6.43 (s, 1H, 5-H), 5.16 (m, 1H, 1'-H), 2.85 (t, 2H, J = 7.4 Hz, α-CH₂), 2.19 (m, 2H, CH₂), 1.94 (m, 2H, CH₂), 1.84 (m, 2H, CH₂), 1.72 (m, 2H, CH₂), 1.58-1.32 (m, 18H, 9 x CH₂), 0.99 (t, 3H, J = 6.4 Hz, CH₃); ¹³C NMR (CDCl₃) δ 168.9 (7a-C), 162.3 (2-C), 158.9 (6-C), 151.0 (4-CH), 114.0 (4a-C), 99.6 (5-CH), 75.8 (1'-CH), 32.3 (CH₂), 32.0 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (2 x CH₂), 29.5 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 26.0 (CH₂), 24.3 (2 x CH₂), 23.1 (CH₂), 14.6 (CH₃).

3-Cyclohexyl-6-decyl-2,3-dihydrofuro[2,3-d]pyrimidin-2-one Cf2295



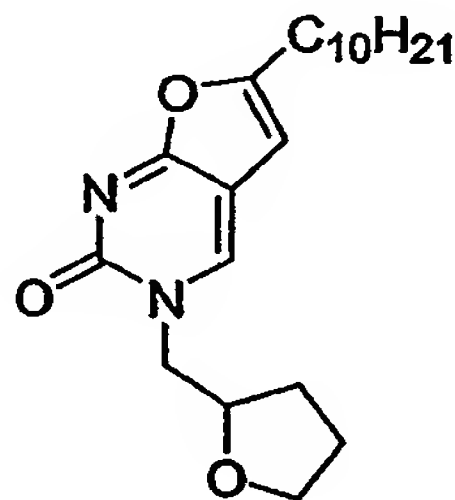
10

Also isolated from the above reaction was *the title compound 47* (23 mg, 6 %) as a white solid. ¹H NMR (CDCl₃) 7.86 (s, 1H, 4-H), 6.13 (s, 1H, 5-H), 4.90 (m, 1H, 1'-H), 2.68 (t, 2H, J = 7.4 Hz, α-CH₂), 2.09-1.30 (m, 26H, 13 x CH₂), 0.93 (t, 3H, J = 6.2 Hz, CH₃); ¹³C NMR (CDCl₃) δ 171.5 (7a-C), 160.3 (2-C), 155.8 (6-H), 135.6 (4-CH), 108.1 (4a-C), 98.9 (5-CH), 57.1 (1'-CH), 33.3 (CH₂), 32.3 (CH₂), 32.0 (2 x CH₂), 29.7 (2 x CH₂), 26.2 (CH₂), 25.8 (CH₂), 24.3 (CH₂), 23.1 (CH₂), 14.6 (CH₃).

15

6-Decyl-3-(tetrahydro-furan-2-ylmethyl)-3H-furo[2,3-d]pyrimidin-2-one 72 Cf2309

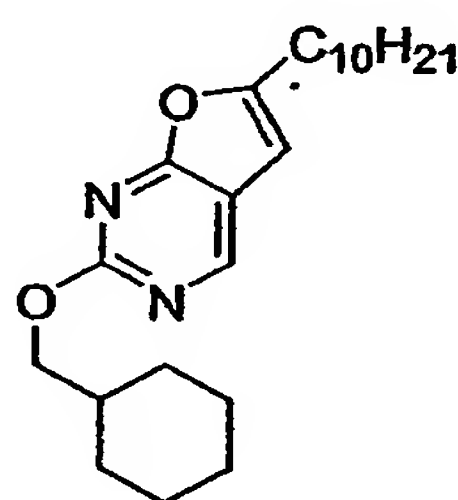
20



The title compound 72 (157 mg, 42 %) was also isolated from the reaction mixture as a white solid.

¹H NMR (CDCl₃) δ 7.95 (s, 1H, 4-H), 6.13 (s, 1H, 5-H), 4.55 (dd, *J* = 2.3, 13.6 Hz, 1H, N-CH₂-THF), 4.29 (m, 1H, N-CH₂-THF), 3.93-3.72 (m, 3H, THF-CH), 2.68 (t, *J* = 7.4 Hz, 2H, 1'-CH₂), 2.26-2.15 (m, 1H, THF-CH), 2.00-1.90 (m, 2H, CH₂), 1.71-1.63 (m, 3H, THF-CH), 1.37-1.31 (m, 14H, CH₂), 0.93 (t, *J* = 6.4 Hz, 3H, CH₃); ¹³C NMR (CDCl₃) δ 172.4 (7a-C), 160.2 (2-C), 156.1 (6-C), 140.5 (4-CH), 107.9 (4a-C), 98.9 (5-CH), 77.3 (THF-C), 68.6 (THF-C), 54.9 (N-1'-CH₂-THF), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.8 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 29.2 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 26.2 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

2-Cyclohexylmethoxy-6-decyl-furo[2,3-*d*]pyrimidine Cf2274



15

26 (0.30 g, 1.086 mmol) and potassium carbonate (0.30 g, 2.17 mmol, 2 equiv) were suspended in dry DMF (10 mL) under N₂, and (bromomethyl)cyclohexane 48 (0.30 mL, 2.17 mmol, 2 equiv.) added *via* syringe to the resultant stirred suspension. The suspension was then heated to 120 °C with stirring for 3 h, then allowed to cool with stirring overnight. The solvent was then removed *in vacuo* at 80 °C, and the crude mixture purified by flash chromatography in a 0-2% methanol/DCM eluent gradient to yield 49 (189 mg, 47 %) as white solid.

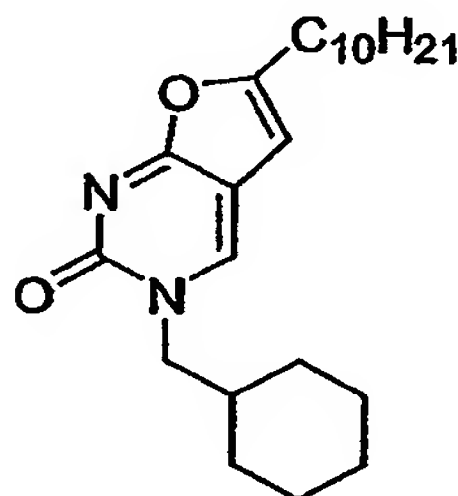
¹H NMR (CDCl₃) δ 8.63 (s, 1H, 4-H), 6.67 (s, 1H, 5-H), 4.35 (d, *J* = 6.2 Hz, 2H, O-CH₂-CyHx), 2.79 (t, *J* = 7.4 Hz, 2H, 1'-CH₂), 1.97-1.90 (m, 3H, CyHx-CH), 1.78 (m, 6H, CyHx-CH), 1.38-1.31 (m, 16H, CH₂), 1.19-1.08 (m, 2H, CyHx-CH), 0.91 (t, *J* = 6.4 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 168.9 (7a-C), 163.0 (2-C), 159.1 (6-C), 150.9 (4-CH), 114.2 (4a-C), 99.5 (5-CH), 73.6 (O-CH₂-CyHx), 37.7 (CyHx-C), 32.3 (1'-CH₂), 30.2

25

(CyHx-C), 30.0 (2 X CH₂), 29.8 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 26.9 (CH₂), 26.2 (2 X CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

3-Cyclohexylmethyl-6-decyl-3H-furo[2,3-d]pyrimidin-2-one Cf2275

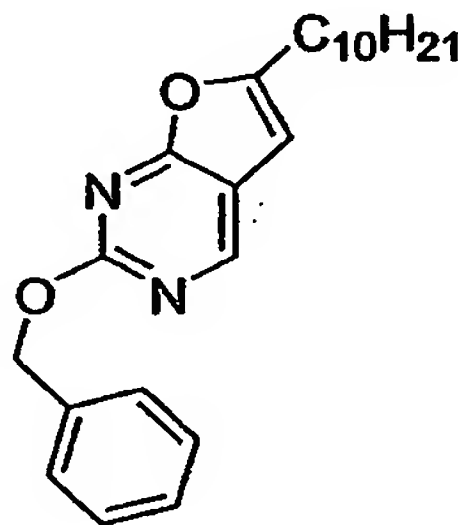
5



Also isolated from the mix as a white solid in a yield of 33 % (129 mg) was *the title compound 50*.

- 10 ¹H NMR (CDCl₃) δ 7.72 (s, 1H, 4-H), 6.12 (s, 1H, 5-H), 3.64 (d, *J* = 7.3 Hz, 2H, N-CH₂-CyHx), 2.66 (t, *J* = 7.5 Hz, 2H, 1'-CH₂), 2.04-1.95 (m, 1H, CyHx-CH), 1.94-1.68 (m, 6H, CyHx-CH), 1.35-1.29 (m, 16H, CH₂), 1.23 (m, 2H, CyHx-CH), 1.02 (m, 2H, CyHx-CH), 0.90 (t, *J* = 6.4 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 172.3 (7a-C), 160.3 (2-C), 156.0 (6-C), 139.7 (4-CH), 107.7 (4a-C), 98.7 (5-CH), 58.8 (N-CH₂-CyHx), 36.9 (CyHx-C), 32.3
- 15 (1'-CH₂), 30.9 (CyHx-C), 30.0 (CH₂), 29.9 (CH₂), 29.8 (CH₂), 29.6 (CH₂), 29.5 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 26.6 (CH₂), 26.0 (2 X CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

2-Benzyloxy-6-decyl-furo[2,3-d]pyrimidine Cf2307



20

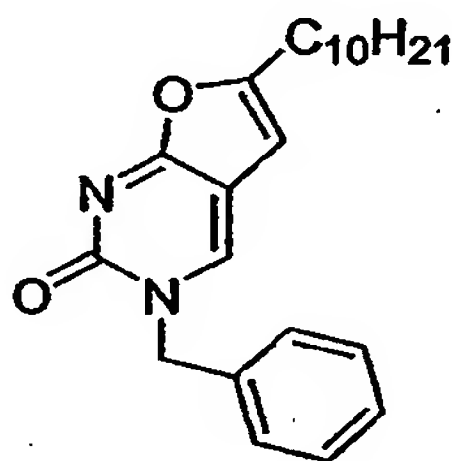
26 (0.30 g, 1.086 mmol), potassium carbonate (0.30 g, 2.17 mmol, 2 equiv) and benzyl chloride (51, 0.25 mL, 2.17 mmol, 2 equiv.) were suspended in dry DMF (5 mL) under N₂,

and the reaction mixture heated to 100 °C with stirring overnight. The solvent was then removed *in vacuo* at 80 °C, and the crude mixture purified by flash chromatography in a 0-5 % methanol/DCM eluent gradient to yield **52** (54 mg, 14 %) as white solid.

¹H NMR (CDCl₃) δ 8.66 (s, 1H, 4-H), 7.57 (d, *J* = 6.7 Hz, 2H, Ar-CH), 7.36 (m, 3H, Ar-CH), 6.40 (s, 1H, 5-H), 5.54 (s, 2H, O-CH₂-Ph), 2.78 (t, *J* = 7.2 Hz, 2H, 1'-CH₂), 1.79 (m, 2H, CH₂), 1.32 (m, 14H, CH₂), 0.92 (m, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 168.8 (7a-C), 162.5 (2-C), 159.4 (6-C), 150.9 (4-CH), 137.0 (Ar-C), 128.8 (Ar-C), 128.4 (Ar-C), 128.3 (Ar-C), 113.9 (4a-C), 99.6 (5-CH), 69.7 (O-CH₂-Ph), 32.3 (1'-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (2 X CH₂), 29.5 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

10

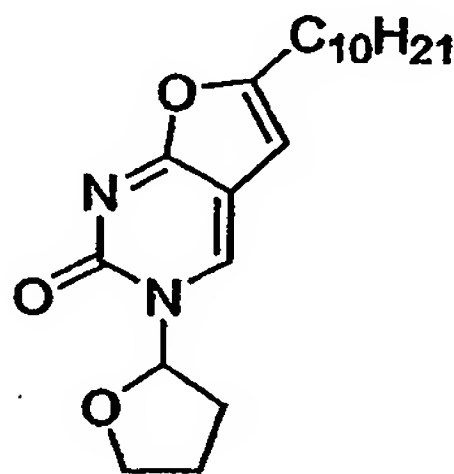
3-Benzyl-6-decyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2308



15 Also isolated from the crude residue was *the title compound* **53** (258 mg, 65 %) as white solid.

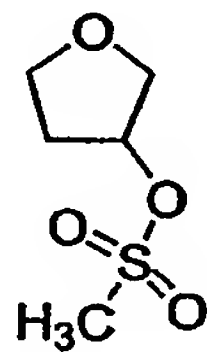
¹H NMR (CDCl₃) δ 7.74 (s, 1H, 4-H), 7.42 (m, 5H, Ar-CH), 6.07 (s, 1H, 5-H), 5.26 (s, 2H, N-CH₂-Ph), 2.67 (t, *J* = 7.3 Hz, 2H, 1'-CH₂), 1.83 (m, 2H, CH₂), 1.66 (m, 14H, CH₂), 0.93 (t, *J* = 6.9 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 172.3 (7a-C), 160.8 (2-C), 156.1 (6-C), 138.3 (4-CH), 135.9 (Ar-C), 129.6 (Ar-C), 129.1 (Ar-C), 129.0 (Ar-C), 108.6 (4a-C), 98.8 (5-CH), 54.4 (N-CH₂-Ph), 32.3 (1'-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 23.1 (CH₂), 14.5 (-CH₂CH₃).

20

6-Decyl-3-(tetrahydro-furan-2'-yl)-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one Cf2249

26 (0.30 g, 0.19 mmol) and a catalytic amount of DMAP were suspended in dry DMF (8 mL) under an atmosphere of N₂, and 2-*tert*-butoxytetrahydrofuran 54 (0.34 mL, 0.31 g, 2.17 mmol, 2 equiv.) added *via* syringe with stirring. The resultant green suspension was heated to 150 °C for 5 h with stirring, then the solvent was removed under reduced pressure at 80 °C. The residue was purified *via* flash column chromatography in DCM to yield 90 mg (24 %) of *the title compound* 55 as a pale yellow compound.

¹H NMR (CDCl₃) δ 7.95 (s, 1H, 4-H), 6.10 (m, 2H, 5-H and 2'-H), 4.29 (m, 1H, 5'-H), 4.06 (m, 1H, 5'-H), 2.63 (t, 2H, *J* = 7.5 Hz, α-CH₂), 2.56 (m, 1H, THF-CH), 2.17 (m, 1H, THF-CH), 2.01 (m, 1H, THF-CH), 1.83 (m, 1H, THF-CH), 1.66 (m, 2H, CH₂), 1.30-1.1.9 (m, 14H, 7 x CH₂), 0.86 (t, 3H, *J* = 6.3 Hz, CH₃); ¹³C NMR (CDCl₃) δ 171.9 (7a-C), 160.0 (6-C), 155.2 (2-C), 134.2 (4-CH), 107.6 (4a-C), 99.1 (5-CH), 90.2 (2'-CH), 71.1 (5'-CH₂), 33.8 (CH₂), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (2 x CH₂), 29.5 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 23.7 (CH₂), 23.1 (CH₂), 14.6 (CH₃).

Methanesulfonic acid tetrahydro-furan-3-yl ester 64

20

3-Hydroxytetrahydrofuran 57 (0.50 g, 0.46 mL, 5.5 mmol) and triethylamine (1 mL, 7 mmol, 1.3 equiv.) were dissolved in dry DCM (5 mL) and the solution cooled to 0 °C with stirring. Methanesulfonyl chloride 63 (0.55 mL, 7 mmol, 1.3 equiv.) was added slowly *via* syringe to the chilled solution. The solution was allowed to warm to RT, and the resultant suspension stirred at RT for 24 h. Dry DCM (20 mL) was then added to the suspension to

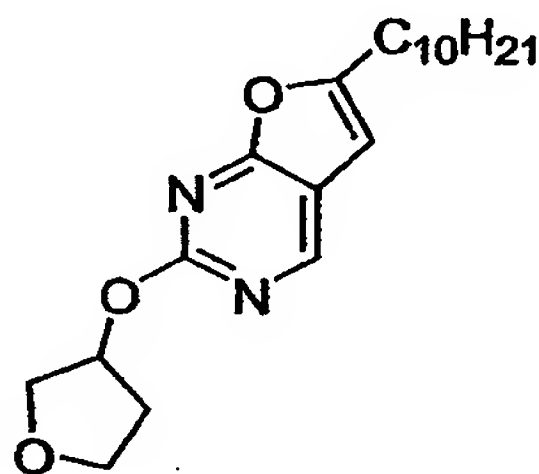
25

re-form a solution. The solution was allowed to stir at RT for a further 36 h. The solvent was removed *in vacuo* and the residue dissolved in water. The aqueous solution was extracted with DCM. The DCM extracts were then washed with brine, and the brine washings extracted with fresh DCM. The combined organic layers were then dried over 5 MgSO₄. The solvent was removed under reduced pressure to yield 64 as a yellow viscous liquid (0.80 g, 96 %), which was used without further purification.

¹H NMR (CDCl₃) δ 5.20 (m, 1H, 1'-CH), 3.94-3.74 (m, 4H, THF-CH), 2.96 (s, 3H, CH₃), 2.18-2.11 (m, 2H, THF-CH); ¹³C NMR (CDCl₃): 81.38 (1'-CH), 73.4 (2'-CH₂), 67.1 (4'-CH₂), 38.8 (CH₃), 33.7 (3'-CH₂).

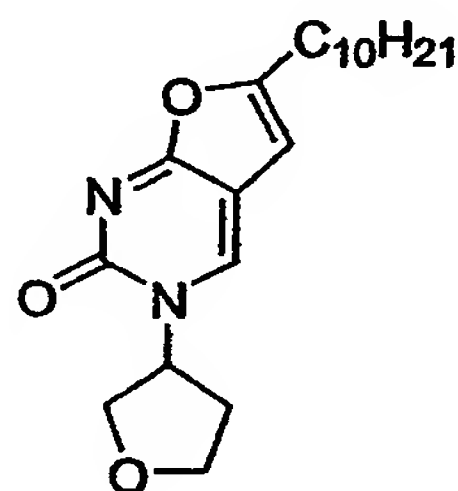
10

6-Decyl-2-(tetrahydro-furan-3-yloxy)-furo[2,3-*d*]pyrimidine 58



15 26 (0.182 g, 0.66 mmol), potassium carbonate (0.182 g, 1.33 mmol, 2 equiv) and methanesulfonic acid tetrahydro-furan-3-yl ester 64 (0.105 g, 0.63 mmol, 0.95 equiv) were suspended in dry DMF (5 mL) under N₂, and the reaction mixture heated to 80 °C with stirring for 8 h. The solvent was then removed *in vacuo* at 80 °C, and the resultant residue purified by flash chromatography in a 0-5 % methanol/DCM eluent gradient to yield 58 20 (140 mg, 62 %) as white solid.

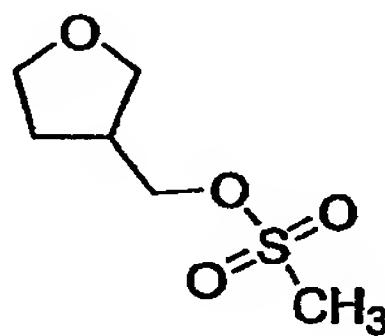
¹H NMR (CDCl₃) δ 8.64 (s, 1H, 4-H), 6.40 (s, 1H, 5-H), 5.64-5.59 (m, 1H, O-1'-THF), 4.07-3.96 (m, 4H, THF-CH), 2.80 (t, *J* = 7.5 Hz, 2H, 1'-CH₂), 1.79 (quin, *J* = 7.6 Hz, 2H, CH₂), 1.39-1.31 (m, 14H, CH₂), 0.93 (t, *J* = 6.5 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 168.6 (7a-C), 163.0 (2-C), 159.5 (6-C), 151.0 (4-CH), 114.6 (4a-C), 99.6 (5-CH), 78.2 (1'-THF-C), 78.2 (THF-C), 73.8 (THF-C), 67.7 (1'-THF-C), 33.5 (1'-CH₂), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.8 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

6-Decyl-3-(tetrahydro-furan-3-yl)-3H-furo[2,3-d]pyrimidin-2-one Cf2276

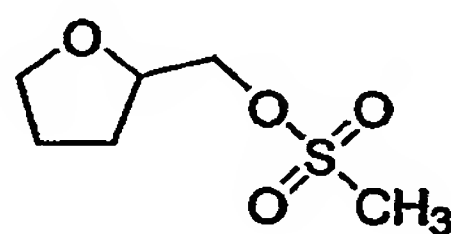
- 5 Also isolated from the residue was *the title compound 59* as a white solid (22 mg, 10 %). ¹H NMR (CDCl₃) δ 8.00 (s, 1H, 4-H), 6.12 (s, 1H, 5-H), 5.68 (m, 1H, N-1'-THF), 4.23-4.09 (m, 2H, THF-CH), 3.97-3.86 (m, 2H, THF-CH), 2.68 (m, 2H, 1'-CH₂), 1.72 (m, 2H, CH₂), 1.36-1.30 (m, 16H, CH₂), 0.91 (t, *J* = 6.3 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 171.8 (7a-C), 160.7 (2-C), 156.0 (6-C), 136.0 (4-CH), 109.1 (4a-C), 99.1 (5-CH), 73.4 (1'-THF-C), 78.2 (THF-C), 67.6 (THF-C), 58.1 (1'-THF-C), 34.2 (1'-CH₂), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 23.1 (CH₂), 14.5 (-CH₂CH₃).
- 10

Methanesulfonic acid tetrahydro-furan-3-yl methyl ester 66

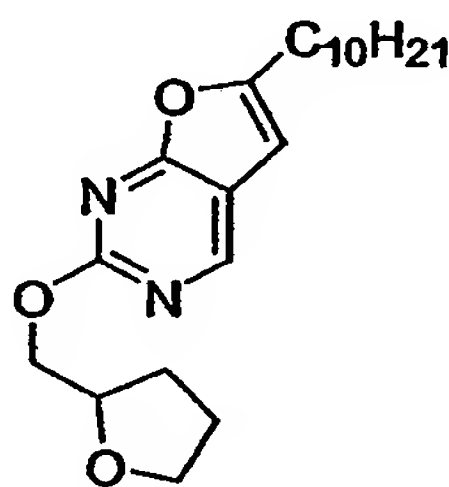
15



- Tetrahydro-3-furan methanol 65 (0.50 g, 4.9 mmol) was dissolved in dry DCM (30 mL) and triethylamine (1.06 mL, 8.8 mmol, 1.8 equiv) was added to the solution *via* syringe under N₂ with stirring. The solution was cooled to 0 °C and methanesulfonyl chloride 63 (0.68 mL, 8.8 mmol, 1.8 equiv) added dropwise *via* syringe. The resultant solution was allowed to warm to RT and stirred at RT for 36 h. The solvent was then removed *in vacuo*. The residue was dissolved in fresh DCM and water (25 mL) added to the solution. The solution was then extracted with DCM. The DCM extracts were washed with brine, and the brine back-extracted with DCM. The combined DCM extracts were then reduced *in vacuo* to yield a yellow oil (66, 0.88 g, quantitative).
- 20
- 25

Methanesulfonic acid tetrahydro-furan-2-yl methyl ester 70

5 Tetrahydrofurfuryl alcohol 69 (0.50 g, 4.9 mmol) was dissolved in dry DCM (30 mL) and triethylamine (1.06 mL, 8.8 mmol, 1.8 equiv) was added to the solution *via* syringe under N₂ with stirring. The solution was cooled to 0 °C and methanesulfonyl chloride 63 (0.68 mL, 8.8 mmol, 1.8 equiv) added dropwise *via* syringe to the cooled solution. The resultant solution was allowed to warm to RT and stirred at RT for 36 h. The solvent was then
10 removed *in vacuo*. The residue was dissolved in fresh DCM and water (25 mL) added to the solution. The solution was then extracted with DCM. The DCM extracts were washed with brine, and the brine back-extracted with DCM. The combined DCM extracts were dried (MgSO₄), then reduced *in vacuo* to yield a yellow oil (70, 0.86 g, 98 %).

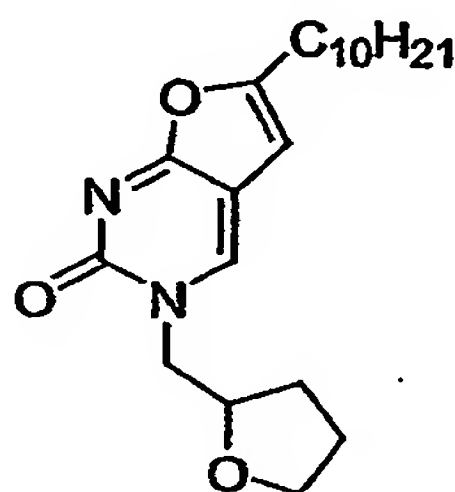
15 6-Decyl-2-(tetrahydro-furan-2-ylmethoxy)-furo[2,3-*d*]pyrimidine 71

26 (0.182 g, 1.086 mmol), potassium carbonate (0.182 g, 2.17 mmol, 2 equiv) and methanesulfonic acid tetrahydro-furan-2-ylmethyl ester 70 (0.186 g, 1.086 mmol) were
20 suspended in dry DMF (5 mL) under N₂, and the reaction mixture heated to 100 °C with stirring under N₂ for 8 h. The solvent was removed *in vacuo*. The resultant residue was suspended in water (100 mL) and extracted with DCM (5 X 50 mL), then washed with brine. The combined DCM extracts were dried over MgSO₄, filtered, reduced *in vacuo* and purified by flash column chromatography in a carefully altered 0-5 % methanol/DCM
25 solvent eluent gradient to yield 120 mg (32 %) of the title compound 71 as a white solid.

^1H NMR (CDCl_3) δ 8.63 (s, 1H, 4-H), 6.39 (s, 1H, 5-H), 4.49–4.36 (m, 3H, THF-CH), 4.03–3.94 (m, 1H, O-CH₂-THF), 3.91–3.84 (m, 1H, O-CH₂-THF), 2.79 (t, J = 7.4 Hz, 2H, 1'-CH₂), 2.19–1.84 (m, 4H, THF-CH), 1.80–1.73 (m, 2H, CH₂), 1.38–1.31 (m, 14H, CH₂), 0.93 (t, J = 6.4 Hz, 3H, CH₃); ^{13}C NMR (CDCl_3) δ 168.8 (7a-C), 162.6 (2-C), 159.3 (6-C), 150.9 (4-CH), 114.5 (4a-C), 99.5 (5-CH), 77.6 (THF-C), 70.1 (THF-C), 68.9 (O-1'-CH₂-THF), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (2 X CH₂), 29.5 (CH₂), 28.8 (CH₂), 28.7 (CH₂), 27.6 (CH₂), 26.1 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

6-Decyl-3-(tetrahydro-furan-2-ylmethyl)-3H-furo[2,3-*d*]pyrimidin-2-one 72

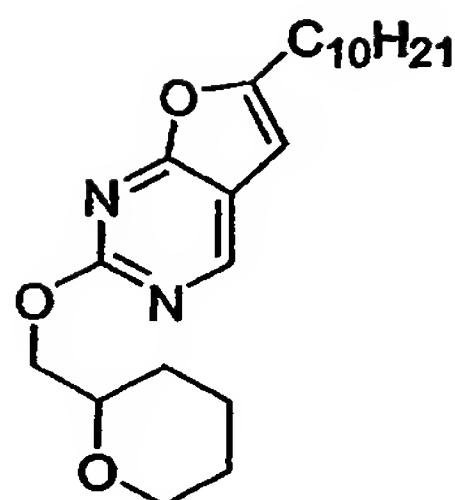
10



The title compound 72 (157 mg, 42 %) was also isolated from the reaction mixture as a white solid. ^1H NMR (CDCl_3) δ 7.95 (s, 1H, 4-H), 6.13 (s, 1H, 5-H), 4.55 (dd, J = 2.3, 13.6 Hz, 1H, N-CH₂-THF), 4.29 (m, 1H, N-CH₂-THF), 3.93–3.72 (m, 3H, THF-CH), 2.68 (t, J = 7.4 Hz, 2H, 1'-CH₂), 2.26–2.15 (m, 1H, THF-CH), 2.00–1.90 (m, 2H, CH₂), 1.71–1.63 (m, 3H, THF-CH), 1.37–1.31 (m, 14H, CH₂), 0.93 (t, J = 6.4 Hz, 3H, CH₃); ^{13}C NMR (CDCl_3) δ 172.4 (7a-C), 160.2 (2-C), 156.1 (6-C), 140.5 (4-CH), 107.9 (4a-C), 98.9 (5-CH), 77.3 (THF-C), 68.6 (THF-C), 54.9 (N-1'-CH₂-THF), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.8 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 29.2 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 26.2 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

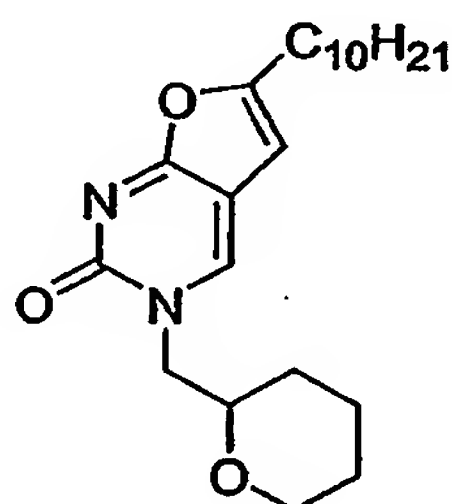
6-Decyl-2-(tetrahydro-pyran-2-ylmethoxy)-furo[2,3-*d*]pyrimidine 61

40



26 (0.30 g, 1.086 mmol), potassium carbonate (0.30 g, 2.17 mmol, 2 equiv) were suspended in dry DMF (5 mL) under N₂, and 2-(bromomethyl)tetrahydro-2*H*-pyran 74
 5 (0.28 mL, 2.17 mmol, 2 equiv) added *via* syringe with stirring under N₂. The resultant mixture was heated to 110 °C with stirring overnight. The solvent was then removed *in vacuo* at 80 °C, and the residue suspended in water (100 mL) and extracted with DCM (5 X 50 mL). The combined DCM extracts were washed with brine, dried over MgSO₄, filtered, reduced *in vacuo* and purified slowly by flash chromatography in a DCM, then
 10 carefully altered 0-5 % methanol/DCM eluent gradient to yield *the title compound 61* as a white solid (120 mg, 30 %) as a white solid. ¹H NMR (CDCl₃) δ 8.63 (s, 1H, 4-H), 6.38 (s, 1H, 5-H), 4.50-4.34 (m, 2H, O-CH₂-THP), 4.08 (m, 1H, THP-CH), 3.83 (m, 1H, THP-CH), 3.54 (t, *J* = 11.3 Hz, 1H, THP-CH), 2.79 (t, *J* = 7.4 Hz, 2H, 1'-CH₂), 1.97-1.94 (m, 1H, THP-CH), 1.76 (app d, *J* = 7.6 Hz, 2H, CH₂), 1.39-1.31 (m, 16H, CH₂), 0.93 (t, *J* = 6.5
 15 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 168.8 (7a-C), 162.6 (2-C), 159.3 (6-C), 150.9 (4-CH), 114.5 (4a-C), 99.5 (5-CH), 76.0 (THP-C), 71.3 (THP-C), 67.7 (1'-CH₂-THP), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.8 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 28.8 (CH₂), 28.5 (CH₂), 27.6 (CH₂), 26.3 (CH₂), 23.5 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

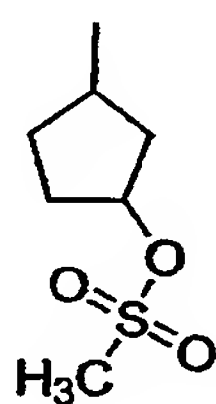
20 **6-Decyl-3-(tetrahydro-pyran-2-ylmethyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one 62**



Also isolated from the mixture was 62, the title compound in 26 % yield (105 mg) as a white compound.

¹H NMR (CDCl₃) δ 7.84 (s, 1H, 4-H), 6.11 (s, 1H, 5-H), 4.48 (dd, *J* = 1.9, 6.7 Hz, 1H, N-CH₂-THP), 3.92 (app d, *J* = 10.7 Hz, 1H, THP-CH), 3.71 (m, 1H, THP-CH), 3.52 (app q, *J* = 4.5, 6.7 Hz, 1H, THP-CH), 3.38-3.30 (m, 1H, THP-CH), 2.66 (t, *J* = 7.4 Hz, 2H, 1'-CH₂), 1.97-1.94 (m, 1H, THP-CH), 1.88-1.47 (m, 4H, CH₂), 1.35-1.29 (m, 18H, CH₂), 0.91 (t, *J* = 6.5 Hz, 3H, -CH₂CH₃); ¹³C NMR (CDCl₃) δ 172.5 (7a-C), 160.0 (2-C), 156.1 (6-C), 141.1 (4-CH), 107.5 (4a-C), 98.9 (5-CH), 75.3 (THP-C), 68.7 (THP-C), 56.6 (1'-CH₂-THP), 32.3 (CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.8 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 26.3 (CH₂), 23.3 (CH₂), 23.1 (CH₂), 14.6 (-CH₂CH₃).

Methanesulfonic acid 3-methyl-cyclopentyl ester 76



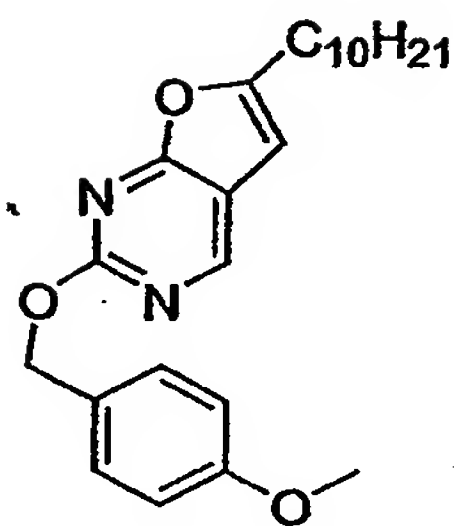
15

3-Methylcyclopentanol 75 (0.5 g, 4.99 mmol) was dissolved in dry DCM (25 mL), and triethylamine (0.8 mL, 6.5 mmol, 1.3 equiv) added to the stirred solution under N₂, which was then cooled to 0 °C. Methanesulfonyl chloride (0.5 mL, 6.5 mmol, 1.3 equiv) was added dropwise *via* syringe to the chilled solution, the resultant solution warmed to RT and allowed to react at RT with stirring for 36 h. The solvent was removed *in vacuo*, and the residue dissolved in water (50 mL), which was extracted with DCM (5 X 50 mL). The combined DCM extracts were washed with brine (which was back extracted with fresh DCM (25mL)), dried (MgSO₄), filtered and reduced under vacuum to yield a clear yellow oil (789 mg, 88 %).

25

6-Decyl-2-(4-methoxybenzyloxy)-3H-furo[2,3-*d*]pyrimidine Cf2315

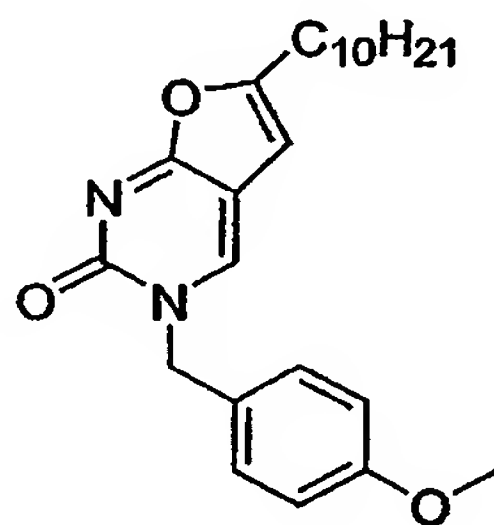
42



- 6-Decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one 26 (0.50 g, 1.81 mmol) and potassium carbonate (0.50 g, 3.62 mmol, 2 equiv.) were suspended in dry DMF (6 mL), and 4-methoxybenzyl chloride (0.5 mL, 3.62 mmol, 2 equiv) added to the stirred solution *via* syringe under N₂. The resultant mixture was heated with stirring to 120 °C overnight. The solvent were removed *in vacuo* at 80 °C, then the residue purified by flash column chromatography in a 0-5 % MeOH/DCM eluent gradient to yield *the title compound* X (63 mg, 9 %) as a white solid.
- 10 ¹H NMR (CDCl₃) δ 8.61 (s, 1H, H-4), 7.48 (d, *J* = 8.4 Hz, 2H, Ar-CH), 6.93 (d, *J* = 8.7 Hz, 2H, Ar-CH), 6.35 (s, 1H, H-5), 5.44 (s, 2H, Ph-CH₂), 3.82 (s, 3H, O-CH₃), 2.77 (t, *J* = 7.3 Hz, 2H, α-CH₂), 1.75 (qt, *J* = 7.3 Hz, 2H, CH₂), 1.40-1.29 (m, 14H, CH₂), 0.91 (t, *J* = 7.0 Hz, 3H, CH₃); ¹³C NMR (CDCl₃) δ 168.2 (7a-C), 159.6 (C-2), 159.3 (C-6), 149.9 (4-CH), 130.8 (Ar-CH), 129.7 (Ar-CH), 116.2 (Ar-CH), 114.3 (Ar-CH), 99.7 (5-CH), 69.7 (Ph-CH₂), 32.3 (α-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 23.5 (CH₂), 21.1 (CH₂), 14.6 (CH₃).
- 15

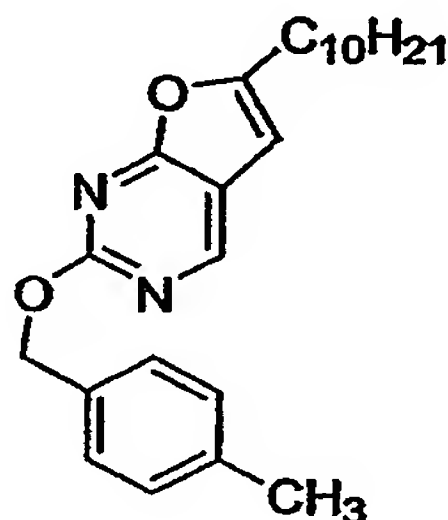
6-Decyl-3-(4-methoxybenzyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2316

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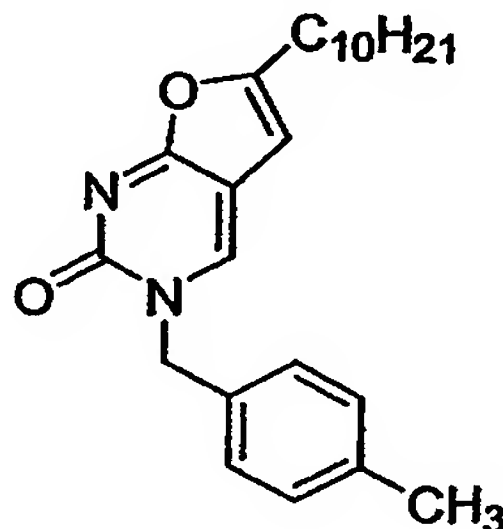
Also obtained from the mixture was the *title compound* as a white solid **34** (312 mg, 44 %).
¹H NMR (CDCl₃) δ 7.70 (s, 1H, H-4), 7.35 (d, *J* = 8.0 Hz, 2H, Ar-CH), 6.95 (d, *J* = 7.8 Hz, 2H, Ar-CH), 6.06 (s, 1H, H-5), 5.18 (s, 2H, Ph-CH₂), 3.86 (s, 3H, O-CH₃), 2.66 (t, *J* = 7.5 Hz, 2H, α-CH₂), 1.69 (m, 2H, CH₂), 1.40-1.31 (m, 14H, CH₂), 0.93 (t, *J* = 7.2 Hz, 3H, CH₃);
¹³C NMR (CDCl₃) δ 172.4 (7a-C), 160.6 (C-2), 155.8 (C-6), 138.1 (4-CH), 130.7 (Ar-CH), 128.5 (Ar-CH), 114.9 (Ar-CH), 108.2 (4a-C), 98.9 (5-CH), 55.7 (O-CH₃), 54.0 (Ph-CH₂), 32.3 (α-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.2 (CH₂), 23.1 (CH₂), 14.6 (CH₃).

10 **6-Decyl-2-(4-methylbenzyloxy)-3H-furo[2,3-*d*]pyrimidine Cf2313**



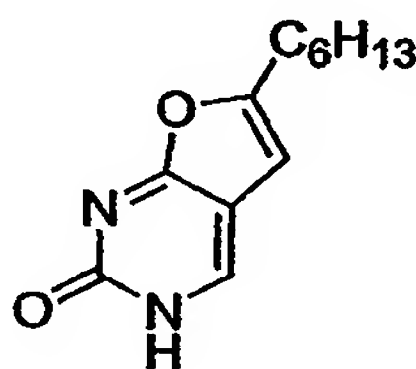
6-Decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one **26** (0.50 g, 1.81 mmol), potassium carbonate (0.50 g, 3.62 mmol, 2 equiv) were suspended in dry DMF (5 ml) and 4-methylbenzyl chloride (0.5 mL, 3.62 mmol, 2 equiv) added to the stirred suspension under N₂ via syringe. The resultant mixture was then heated at 100 °C overnight. The solvents were removed *in vacuo* at 80 °C and the resultant residue purified by flash column chromatography in a 0-5 % methanol/DCM eluent gradient to yield **30**, the *title product* (105 mg, 15 %), as a white solid.

¹H NMR (CDCl₃) δ 8.64 (s, 1H, H-4), 7.45 (d, *J* = 7.9 Hz, 2H, Ar-CH), 7.21 (d, *J* = 8.0 Hz, 2H, Ar-CH), 6.40 (s, 1H, H-5), 5.49 (s, 2H, Ph-CH₂), 2.80 (t, *J* = 7.4 Hz, 2H, α-CH₂), 2.43 (s, 3H, Ar-CH₃), 1.79 (qt, *J* = 6.8 Hz, 2H, CH₂), 1.47-1.32 (m, 14H, CH₂), 0.94 (t, *J* = 7.2 Hz, 3H, CH₃);
¹³C NMR (CDCl₃) δ 168.8 (7a-C), 162.2 (C-2), 159.3 (C-6), 149.9 (4-CH), 138.5 (Ar-CH), 129.5 (Ar-CH), 128.5 (Ar-CH), 114.3 (Ar-CH), 99.6 (5-CH), 69.6 (Ph-CH₂), 32.3 (α-CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.5 (CH₂), 28.8 (CH₂), 23.1 (CH₂), 21.7 (CH₂), 14.6 (CH₃).

6-Decyl-3-(4-methylbenzyl)-3H-furo[2,3-d]pyrimidin-2-one Cf2314

Also obtained from the mixture was the *title compound* 31 (440 mg, 65 %) as a white solid.

5 ^1H NMR (CDCl_3) δ 7.71 (s, 1H, H-4), 7.30 (d, $J = 8.2$ Hz, 2H, Ar-CH), 7.23 (d, $J = 8.0$ Hz, 2H, Ar-CH), 6.05 (s, 1H, H-5), 5.20 (s, 2H, Ph-CH₂), 2.66 (t, $J = 7.4$ Hz, 2H, α -CH₂), 2.63 (s, 3H, Ar-CH₃), 1.73 (qt, $J = 7.6$ Hz, 2H, CH₂), 1.43-1.32 (m, 14H, CH₂), 0.92 (t, $J = 7.0$ Hz, 3H, CH₃); ^{13}C NMR (CDCl_3) δ 172.3 (7a-C), 160.6 (C-2), 156.2 (C-6), 138.9 (4-CH), 132.8 (Ar-CH), 129.2 (Ar-CH), 128.5 (Ar-CH), 114.3 (Ar-CH), 98.8 (5-CH), 54.2 (Ph-CH₂), 32.3 (α -CH₂), 30.0 (CH₂), 29.9 (CH₂), 29.7 (CH₂), 29.6 (CH₂), 29.4 (CH₂), 28.7 (CH₂), 27.1 (CH₂), 23.1 (CH₂), 21.6 (CH₃), 14.6 (CH₃).

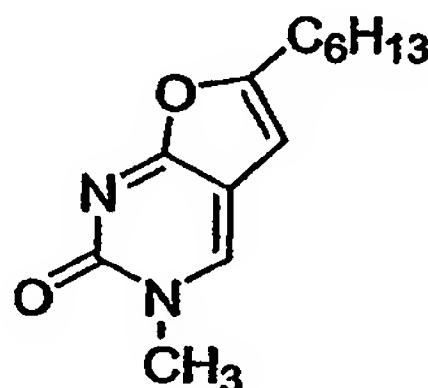
6-Hexyl-2,3-dihydrofuro[2,3-d]pyrimidin-2-one

15

5-Iodouracil 23 (5.00 g, 21 mmol), tetrakis(triphenylphosphine)palladium(0) (1.0 g, 0.87 mmol, 0.04 equiv), and copper iodide (0.80 g, 4.2 mmol, 0.2 equiv) were dissolved in dry DMF (50 mL) with stirring under N₂. DIPEA (7.3 mL, 5.42 g, 42 mmol, 2 equiv), then 1-octyne (9.3 mL, 6.93 g, 63 mmol, 3 equiv) were added sequentially to the solution *via* syringe and the resultant solution, which darkened from golden to dark green over 20 min, left to stir at RT for 18 h. A further addition of copper iodide (0.80 g) was then made, followed by triethylamine (25 mL) and the resultant suspension heated at 120 °C for 6 h. The suspension was allowed to cool, the volume of solvent reduced to *ca.* 20 mL, and the solid collected by filtration, washed with DCM and methanol to yield a grey powder of

weight 3.13 g (38, 68 %). ^1H NMR (CDCl_3) δ 12.23 (br, 1H, NH), 8.16 (br, 1H, H-4), 6.38 (br, 1H, H-5), 2.65 (t, $J = 7.1$ Hz, 2H, $\alpha\text{-CH}_2$), 1.63 (qt, $J = 7.4$ Hz, 2H, CH_2), 1.31 (m, 6H, CH_2), 0.88 (t, $J = 6.4$ Hz, 3H, CH_3).

5 6-Hexyl-3-methyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2344

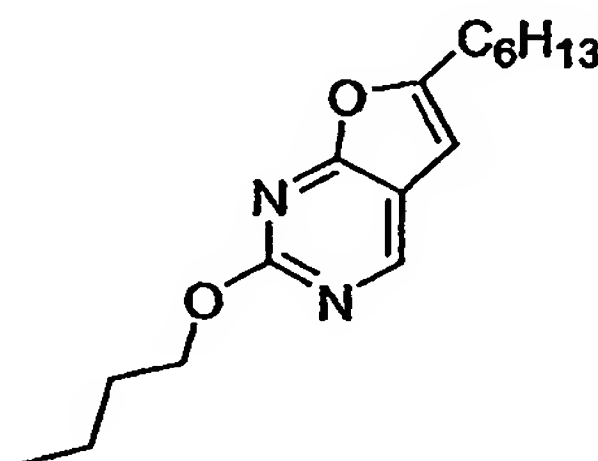


6-Hexyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one 38 (0.40 g, 1.82 mmol) and potassium carbonate (0.50 g, 3.64 mmol, 2 equiv) were suspended in dry DMF (5 mL) under N_2 and methyl iodide (0.23 mL, 3.64 mmol, 2 equiv) added *via* syringe to the stirred suspension, which was then heated to 80 °C overnight. The solvents were removed *in vacuo* and the crude purified by flash column chromatography in a 0-5% MeOH/DCM solvent gradient to yield *the title product* 40 as a white solid in very low yield (25 mg, 6 %).

15 ^1H NMR (CDCl_3) δ 7.76 (s, 1H, H-4), 6.04 (s, 1H, H-5), 3.59 (s, 3H, N- CH_3), 2.59 (t, $J = 7.5$ Hz, 2H, $\alpha\text{-CH}_2$), 1.63 (qt, $J = 7.4$ Hz, 2H, CH_2), 1.35-1.20 (m, 6H, CH_2), 0.83 (t, $J = 7.0$ Hz, 3H, CH_3); ^{13}C NMR (CDCl_3) δ 172.5 (7a-C), 160.5 (C-2), 156.4 (C-6), 139.5 (4-CH), 108.3 (4a-C), 98.6 (5-CH), 40.2 (N- CH_3), 31.8 ($\alpha\text{-CH}_2$), 29.1 (CH_2), 28.7 (CH_2), 27.1 (CH_2), 22.9 (CH_2), 14.5 (CH_3).

20

2-Butyloxy-6-hexyl-furo[2,3-*d*]pyrimidine Cf2346



6-Hexyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one **38** (0.40 g, 1.82 mmol), potassium carbonate (0.50 g, 3.65 mmol, 2 equiv) and 1-iodobutane (0.41 mL, 3.62 mmol, 2 equiv) were suspended in dry DMF (5 mL) under N₂ and heated to 80 °C with stirring overnight. The solvents were removed *in vacuo* and the crude purified by flash column chromatography in a 0-5% MeOH/DCM solvent gradient to yield *the title product 42* as a white solid (180 mg, 36 %).

¹H NMR (CDCl₃) δ 8.65 (s, 1H, H-4), 6.34 (s, 1H, H-5), 4.42 (t, *J* = 6.6 Hz, 2H, O-CH₂-), 2.77 (t, *J* = 7.5 Hz, 2H, α-CH₂), 1.86 (qt, *J* = 7.5 Hz, 2H, CH₂), 1.76 (qt, *J* = 7.5 Hz, 2H, CH₂), 1.55 (m, 2H, CH₂), 1.43-1.31 (m, 6H, CH₂), 1.00 (t, *J* = 7.2 Hz, 3H, CH₃), 0.92 (t, *J* = 6.8 Hz, 3H, CH₃); ¹³C NMR (CDCl₃) δ 168.8 (7a-C), 162.8 (C-2), 159.1 (C-6), 150.8 (4-CH), 99.6 (5-CH), 68.1 (O-CH₂-), 31.9 (α-CH₂), 31.3 (CH₂), 31.2 (CH₂), 29.1 (CH₂), 28.8 (CH₂), 27.6 (CH₂), 22.9 (CH₂), 19.6 (CH₂), 14.5 (CH₃), 14.2 (CH₃).

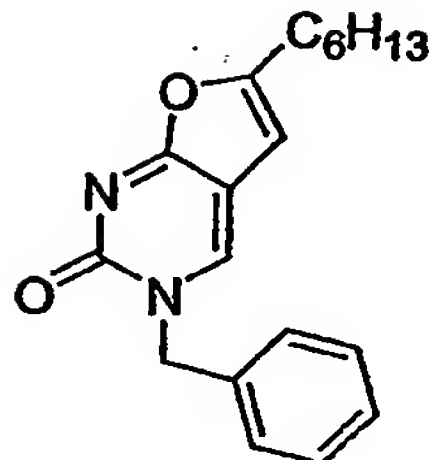
2-Benzyl-6-hexyl-furo[2,3-*d*]pyrimidine Cf2348

6-Hexyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one (**44**, 0.40 g, 1.82 mmol) and potassium carbonate (0.50 g, 3.64 mmol, 2 equiv) were added under N₂ to dry DMF (5 mL), and the resultant suspension charged with benzyl chloride **43** (0.42 mL, 3.64 mmol, 2 equiv), then heated to 80 °C overnight. The solvents were removed *in vacuo* and the crude purified by flash column chromatography in a 0-5% MeOH/DCM eluent gradient to yield 39 mg (**44**, 7 %) of *the title compound* as a white solid.

¹H NMR (CDCl₃) δ 8.65 (br, 1H, H-4), 7.57 (d, *J* = 7.4 Hz, 2H, Ar-CH), 7.46-7.36 (m, 3H, Ar-CH), 6.38 (s, 1H, H-5), 5.53 (s, 2H, Ph-CH₂), 2.81 (t, *J* = 7.6 Hz, 2H, α-CH₂), 1.79 (qt, *J* = 7.4 Hz, 2H, CH₂), 1.47-1.33 (m, 6H, CH₂), 0.95 (t, *J* = 6.8 Hz, 3H, CH₃); ¹³C NMR (CDCl₃) δ 168.8 (7a-C), 162.5 (C-2), 159.4 (C-6), 150.9 (4-CH), 137.0 (Ar-C), 128.8 (Ar-C), 128.4 (Ar-C), 128.3 (Ar-C), 113.9 (4-CH), 99.6 (Ar-C), 69.7 (O-CH₂-Ph), 31.9 (α-CH₂), 29.1 (CH₂), 28.7 (CH₂), 27.1 (CH₂), 23.0 (CH₂), 14.5 (CH₃).

3-Benzyl-6-hexyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2349

47



Also obtained from the purification process was *the title compound 45* as a white solid (391 mg, 69 %).

- 5 ^1H NMR (CDCl_3) δ 7.89 (s, 1H, H-4), 7.49 (m, 5H, Ar-CH), 6.19 (s, 1H, H-5), 5.39 (s, 2H, Ph-CH₂), 2.76 (t, $J = 7.4$ Hz, 2H, α -CH₂), 1.80 (qt, $J = 7.4$ Hz, 2H, CH₂), 1.54-1.38 (m, 6H, CH₂), 1.02 (t, $J = 6.8$ Hz, 3H, CH₃); ^{13}C NMR (CDCl_3) δ 172.2 (7a-C), 160.7 (C-2), 156.1 (C-6), 138.5 (Ar-C), 136.0 (Ar-C), 129.5 (2 x Ar-C), 129.0 (Ar-C), 128.9 (Ar-C), 108.6 (4-CH), 98.9 (5-CH), 54.5 (N-CH₂-Ph), 31.8 (α -CH₂), 29.1 (CH₂), 28.7 (CH₂), 27.1
10 (CH₂), 22.9 (CH₂), 14.5 (CH₃).

Biological Activity

- Products where $X=Y=\text{N}$, $Z=Q=\text{O}$, $U=V=\text{CH}$ and R^1 , R^4 and R^8 are as given in Tables 1
15 and 2 below embodying the present invention were tested *in vitro* in tissue cultures for toxicity and for potent antiviral actions with respect to cytomegalovirus (CMV). The results are given in Tables 1 and 2 below.

The column headings in Tables 1 and 2 are as follows:

20

R^1 , R^4 and R^8 are as defined with respect to formula I above.

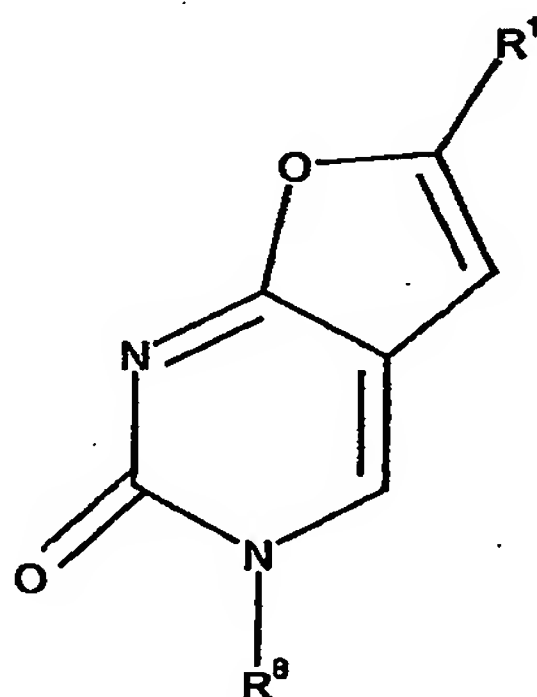
- $\text{EC}_{50}/\mu\text{M}$ CMV-AD169 is the drug concentration in μM required to reduce by 50% CMV strain AD169 induced cytopathicity in human embryonic lung fibroblast (HEL) cells
25 measured 7 days post infection compared to untreated control.

EC₅₀/μM CMV Davis is the drug concentration in μM required to reduce by 50% CMV strain Davis induced cytopathicity in human embryonic lung fibroblast (HEL) cells measured 7 days post infection compared to untreated control.

- 5 CC₅₀/μM is the compound concentration required to reduce the cell number by 50%.

Further details of the methodology employed can be found in McGuigan *et al.* J. Med.Chem., 1999, 42, 4479-4484.

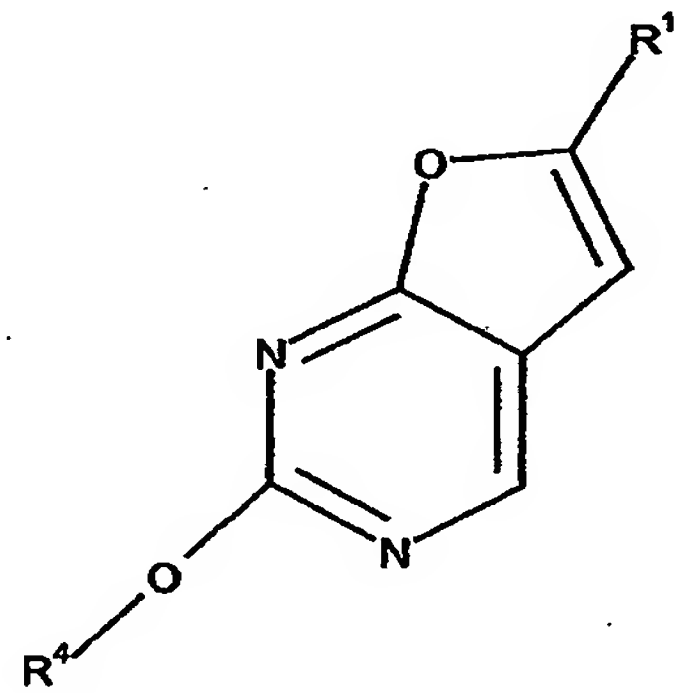
10 **Table 1**



No.	R ¹	R ⁸	EC ₅₀ /μM		CC ₅₀ /μM
			CMV AD169	1 CMV Davis	
2158	nC ₄ H ₉	Cyclo C ₅ H ₉	>50	>50	ND
2160	nC ₇ H ₁₅	Cyclo C ₅ H ₉	5	4	194
2194	nC ₄ H ₉	CH(Et) ₂	>50	>200	>200
2190	nC ₇ H ₁₅	CH(Et) ₂	20	50	>200
2195	nC ₄ H ₉	nC ₅ H ₁₁	>50	>50	>200
2192	nC ₇ H ₁₅	nC ₅ H ₁₁	>200	>200	>200
2196	nC ₇ H ₁₅	2-THF	>20	>20	46
2249	nC ₁₀ H ₂₁	2-THF	>50	50	>200

2275	nC ₁₀ H ₂₁	CH ₂ Cyclo C ₆ H ₁₁	>200	>200	>200
2276	nC ₁₀ H ₂₁	3-THF	20	10	148
2295	nC ₁₀ H ₂₁	Cyclo C ₆ H ₁₁	38	50	>200
2304	nC ₁₀ H ₂₁	C ₃ H ₇	40	8	>200
2306	nC ₁₀ H ₂₁	nC ₄ H ₉	>200	>200	>200
2308	nC ₁₀ H ₂₁	PhCH ₂	>40	>40	>200
2314	nC ₁₀ H ₂₁	TolCH ₂	>40	>40	>200
2316	nC ₁₀ H ₂₁	pMeOPhCH ₂	>200	>200	>200
2309	nC ₁₀ H ₂₁	CH ₂ Cyclo C ₅ H ₉	0.78	0.84	49
2344	nC ₆ H ₁₃	Me	18	20	ND
2345	nC ₆ H ₁₃	nC ₃ H ₇	20	20	ND
2347	nC ₆ H ₁₃	nC ₄ H ₉	19	20	ND
2349	nC ₆ H ₁₃	PhCH ₂	>200	>200	ND

Table 2



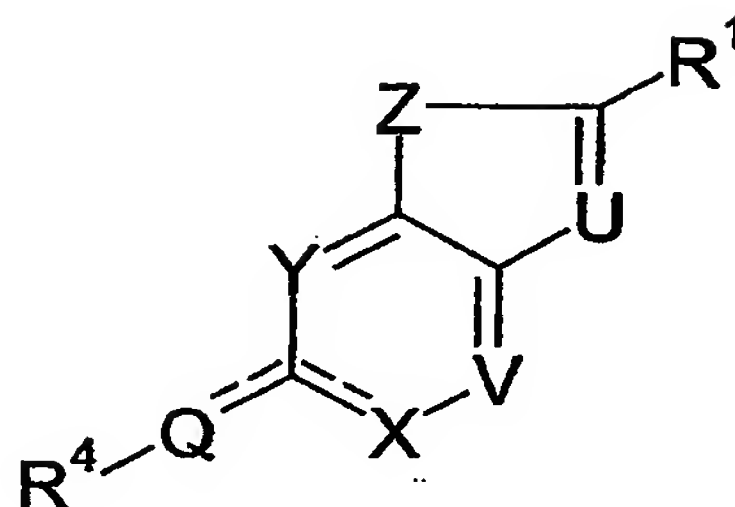
5

No.	R ¹	R ⁴	EC ₅₀ /μM		CC ₅₀ /μM
			CMV AD169	2 CMV Davis	
2159	nC ₄ H ₉	Cyclo C ₅ H ₉	8	7	108
2161	nC ₇ H ₁₅	Cyclo C ₅ H ₉	3	5	132

2193	nC ₄ H ₉	CH(Et) ₂	>20	>20	98
2189	nC ₇ H ₁₅	CH(Et) ₂	>5	12	98
2191	nC ₇ H ₁₅	nC ₅ H ₁₁	>5	16	1109
2247	nC ₁₀ H ₂₁	nC ₅ H ₁₁	>200	>200	>200
2250	nC ₁₀ H ₂₁	Cyclo C ₅ H ₉	>50	>50	>200
2252	nC ₁₀ H ₂₁	CH(Et) ₂	16	10	127
2294	nC ₁₀ H ₂₁	Cyclo C ₆ H ₁₁	12	16	>200
2303	nC ₁₀ H ₂₁	nC ₃ H ₇	2.5	2.1	126
2305	nC ₁₀ H ₂₁	nC ₄ H ₉	3.9	2.7	>200
2307	nC ₁₀ H ₂₁	PhCH ₂	3.3	1.1	>200
2274	nC ₁₀ H ₂₁	CH ₂ CycloC ₆ H ₁₁	4.4	2.9	>200
2313	nC ₁₀ H ₂₁	TolCH ₂	10.5	3.9	>200
2315	nC ₁₀ H ₂₁	pMeOPhCH ₂	3.3	2.9	>200
2343	nC ₆ H ₁₃	Me	>8	4.7	ND
2346	nC ₆ H ₁₃	nC ₄ H ₉	8	3	ND
2348	nC ₆ H ₁₃	PhCH ₂	>200	>3.6	ND

CLAIMS

1. A chemical compound having the formula (I):



5 wherein:

R¹ and R⁴ are independently selected from alkyl, aryl, alkenyl and alkynyl;

10 Z is selected from O, NH, S, Se, NR⁵ and (CH₂)_n where n is 1 to 10, and CT₂ where T may be the same or different and is selected from hydrogen, alkyl and halogens, and R⁵ is alkyl, alkenyl or aryl;

Y is selected from N, CH and CR⁶ where R⁶ is alkyl, alkenyl, alkynyl or aryl;

15 Q is selected from O, S, NH, N-alkyl, CH₂, CHalkyl and C(alkyl)₂;

U is selected from N and CR², R² is selected from hydrogen, alkyl, halogen, amino, alkylamino, dialkylamino, nitro, cyano, alkoxy, aryloxy, thiol, alkylthiol, arylthiol and aryl;

20

V is selected from N and CR³, where R³ is selected from hydrogen, alkyl, halogens, alkyloxy, aryloxy and aryl; and

when a double bond exists between X and the ring atom to which Q is attached and Q is
25 linked to the ring moiety by a single bond, X is selected from N, CH and CR⁷, where R⁷ is selected from alkyl, alkenyl, alkynyl and aryl; and

- when a double bond links Q to the ring moiety and a single bond exists between X and the ring atom to which Q is attached, R^4 does not exist and X is NR^8 , where R^8 is alkyl, alkenyl, alkynyl or aryl, except that when Y is N, R^8 is not an alkyl or alkenyl group substituted at the fourth atom of the chain of said alkyl or alkenyl group, counted along the shortest route away from the ring moiety including any heteroatom present in said chain, by a member selected from OH, phosphate, diphosphate, triphosphate, phosphonate, diphosphonate, triphosphonate and pharmacologically acceptable salts, derivatives and prodrugs thereof;
- 10 and pharmacologically acceptable salts, derivatives and prodrugs of compounds of formula I.
2. A compound according to claim 1 wherein when a double bond exists between X and the ring atom to which Q is attached, X and Y are both N.
- 15 3. A compound according to claim 1 or claim 2 wherein when a double bond exists between X and the ring atom to which Q is attached, Z is O or NH, preferably O.
4. A compound according to any one of claims 1 to 3 wherein when a double bond exists between X and the ring atom to which Q is attached, Q is O.
- 20 5. A compound according to claim 1 wherein X and Y are N, Q and Z are independently selected from O, S and NH, and preferably both Q and Z are O.
- 25 6. A compound according to any one of claims 1 to 5 wherein each of U and V is CH.
7. A compound according to any one of claims 1 to 6 wherein R^1 is selected from C_{3-20} alkyl, C_{3-20} cycloalkyl, C_{3-20} alkenyl, C_{3-20} alkynyl, C_{5-14} aryl and C_{1-10} alkyl C_{5-14} aryl, preferably C_{3-14} alkyl, C_{3-14} alkenyl and C_{3-14} alkynyl, more preferably C_{8-10} alkyl, C_{8-10} alkenyl and C_{8-10} alkynyl.
- 30 8. A compound according to claim 7 wherein R^1 is unbranched and unsubstituted C_{3-12} alkyl, preferably C_{6-10} alkyl.

9. A compound according to anyone of claims 1 to 7 wherein each of R^4 and R^8 is selected from C_{1-12} alkyl, C_{1-12} alkenyl, C_{1-12} alkynyl, C_{3-12} cycloalkyl, C_{1-6} alkyl substituted with C_{3-7} cycloalkyl, C_{1-3} alkyl, C_{5-14} aryl and C_{3-6} cycloalkyl and C_{5-14} aryl containing 1, 2, 3 or 4 hetero ring atoms independently selected from O, N and S, preferably R^4 and R^8 are selected from C_{1-10} alkyl, C_{1-10} alkenyl and C_{1-10} alkynyl.
10. A compound according to any one of claims 1 to 8 wherein R^1 is C_{3-14} alkyl, C_{3-14} alkenyl or C_{3-14} alkynyl, preferably C_{6-14} alkyl, C_{6-14} alkenyl or C_{6-14} alkynyl, and R^4 and R^8 are selected from C_{1-12} alkyl, C_{3-10} cycloalkyl, C_{1-6} alkyl substituted with C_{3-7} cycloalkyl, preferably C_{5-6} alkyl or C_{5-6} cycloalkyl.
11. A compound according to one of claims 1 to 9 wherein R^1 is C_{10} alkyl.
12. A compound according to any one of claims 1 to 11 wherein R^4 and R^8 are selected from benzyl or substituted benzyl.
13. A compound according to any one of claims 1 to 10 wherein R^4 and R^8 are C_1 alkyl substituted with C_{1-10} cycloalkyl, preferably C_1 alkyl substituted with C_{5-6} cycloalkyl.
14. A compound according to claim 1 wherein X and Y are both N, U and V are both CH, Z and Q are independently selected from O, S and NH, and each of R^1 , R^4 and R^8 are C_{8-12} alkyl.
15. A compound selected from the group comprising:
- 6-Butyl-3-cyclopentyl-3*H*-furo[2,3-*d*]pyrimidin-2-one (139) [Cf2158]
- 6-Butyl-2-cyclopentyloxy-furo[2,3-*d*]pyrimidine (130) [Cf2159]
- 6-Heptyl-3-cyclopentyl-3*H*-furo[2,3-*d*]pyrimidin-2-one (140) [Cf2160]
- 6-Heptyl-2-cyclopentyloxy-furo[2,3-*d*]pyrimidine (141) [Cf2161]
- 6-Butyl-3-(1-ethyl-propyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one (142) [Cf2194]
- 6-Butyl-2-(1-ethyl-propoxy)-furo[2,3-*d*]pyrimidine (143) [Cf2193]

- 6-Heptyl-3-(1-ethyl-propyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one (144) [Cf2190]
- 6-Heptyl-2-(1-ethyl-propoxy)-furo[2,3-*d*]pyrimidine (145) [Cf2189]
- 6-Butyl-3-pentyl-3*H*-furo[2,3-*d*]pyrimidin-2-one (146) [Cf2195]
- 6-Butyl-2-pentyloxy-furo[2,3-*d*]pyrimidine (147) [Cf2327]
- 5 6-Heptyl-3-pentyl-3*H*-furo[2,3-*d*]pyrrmidin-2-one (148) [Cf2192]
- 6-Heptyl-3-pentyloxy-3*H*-furo[2,3-*d*]pyrimidin-2-one (149) [Cf2191]
- 6-Heptyl-3-(tetrahydro-furan-2-yl)-3*H*-furo[2,3-*d*]pyrimidin-2-one (154) [Cf2196]
- 6-Decyl-2-propoxy-furo[2,3-*d*]pyrimidine Cf2303
- 6-Decyl-3-propyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2304
- 10 2-Butoxy-6-decyl-furo[2,3-*d*]pyrimidine Cf2305
- 3-Butyl-6-decyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2306
- 6-Decyl-2-pentyloxy-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2247
- 2-Cyclopentyloxy-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2250
- 3-Cyclopentyl-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one Cf2251
- 15 2-(1'-Ethyl-propyloxy)-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2252
- 3-(1'-Ethyl-propyl)-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one Cf2253
- 2-Cyclohexyloxy-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidine Cf2294
- 3-Cyclohexyl-6-decyl-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one Cf2295
- 6-Decyl-3-(tetrahydro-furan-2-ylmethyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one 72
- 20 Cf2309
- 2-Cyclohexylmethoxy-6-decyl-furo[2,3-*d*]pyrimidine Cf2274

- 3-Cyclohexylmethyl-6-decyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2275
- 2-Benzyl-6-decyl-furo[2,3-*d*]pyrimidine Cf2307
- 3-Benzyl-6-decyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2308
- 6-Decyl-3-(tetrahydro-furan-2'-yl)-2,3-dihydrofuro[2,3-*d*]pyrimidin-2-one
5 Cf2249
- 6-Decyl-2-(tetrahydro-furan-3-yloxy)-furo[2,3-*d*]pyrimidine 58
- 6-Decyl-3-(tetrahydro-furan-3-yl)-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2276
- 6-Decyl-2-(tetrahydro-furan-2-ylmethoxy)-furo[2,3-*d*]pyrimidine 71
- 6-Decyl-3-(tetrahydro-furan-2-ylmethyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one 72
- 10 6-Decyl-2-(tetrahydro-pyran-2-ylmethoxy)-furo[2,3-*d*]pyrimidine 61
- 6-Decyl-3-(tetrahydro-pyran-2-ylmethyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one 62
- 6-Decyl-2-(4-methoxybenzyloxy)-3*H*-furo[2,3-*d*]pyrimidine Cf2315
- 6-Decyl-3-(4-methoxybenzyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2316
- 6-Decyl-2-(4-methylbenzyloxy)-3*H*-furo[2,3-*d*]pyrimidine Cf2313
- 15 6-Decyl-3-(4-methylbenzyl)-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2314
- 6-Hexyl-3-methyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2344
- 2-Butyloxy-6-hexyl-furo[2,3-*d*]pyrimidine Cf2346
- 2-Benzyl-6-hexyl-furo[2,3-*d*]pyrimidine Cf2348
- 3-Benzyl-6-hexyl-3*H*-furo[2,3-*d*]pyrimidin-2-one Cf2349.
- 20 16. A method for preparing compounds according to any one of claims 1 to 15 wherein a 5-halo nucleoside analogue is contacted with a terminal alkyne in the presence of a catalyst, or a 5-alkynyl nucleoside is cyclised in the presence of a catalyst.

17. A compound according to any one of claims 1 to 15 for use in a method of treatment.
18. Use of a compound according to any one of claims 1 to 15 in the manufacture of a medicament for the prophylaxis or treatment of viral infection.
- 5 19. Use according to claim 18 wherein the viral infection is a cytomegalovirus viral infection.
20. A method of prophylaxis or treatment of viral infection comprising administration to a patient in need of such treatment an effective dose of a compound according to any of claims 1 to 15.
- 10 21. A method according to claim 20 wherein the viral infection is a cytomegalovirus viral infection.
22. A compound according to any one of claims 1 to 15 in the manufacture of a medicament for use in the prophylaxis or treatment of a viral infection.
23. A compound according to claim 22 wherein the viral infection is a cytomegalovirus
15 viral infection.
24. A pharmaceutical composition comprising a compound according to any one of claims 1 to 15 in combination with a pharmaceutically acceptable excipient.
25. A method of preparing a pharmaceutical composition comprising the step of combining a compound according to any one of claims 1 to 15 with a pharmaceutically
20 acceptable excipient.

INTERNATIONAL SEARCH REPORT

Int. Application No
PCT/GB2004/001687

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C07D491/04 A61P31/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C07D A61P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/083651 A (UNIV KINGSTON) 24 October 2002 (2002-10-24) page 61, compound P17; page 62, compound P30 abstract	1-9, 12, 17, 24, 25
X	ROBINS M J ET AL: "NUCLEIC ACID RELATED COMPOUNDS. 39. EFFICIENT CONVERSION OF 5-iodo to 5-alkynyl and derived 5-substituted uracil bases and nucleosides" JOURNAL OF ORGANIC CHEMISTRY, AMERICAN CHEMICAL SOCIETY, EASTON, US, vol. 48, no. 11, 1983, pages 1854-1862, XP002069924 ISSN: 0022-3263 page 1855, scheme 1, compound 3a -/-	1-8

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

17 August 2004

Date of mailing of the international search report

31/08/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040, Tx 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Schmid, A

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2004/001687

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	J.R. MORRIS ET AL: "Nucleic Acid related compounds 31. Smooth and Efficient Palladium-Copper Catalyzed Coupling of Terminal Alkynes with 5-iodouracil Nucleosides" TETRAHEDRON LETTERS, vol. 22, 1981, pages 421-424, XP002292710 page 422, compounds 3a	1-8
X	J. BALZARINI ET AL: "Lack of Susceptibility of Bicyclic Nucleoside Analogs, Highly Potent Inhibitors of Varicella-Zoster Virus, to the Catabolic Action of Thymidine Phosphorylase and Dihydropyrimidine Dehydrogenase" MOLECULAR PHARMACOLOGY, vol. 61, no. 5, 2002, pages 1140-1145, XP001183059 page 1141, compounds Cf 1381, Cf 2200; figure 2	1-8,17, 20-25

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2004/001687

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 1-3, 14 (all partly)
because they relate to subject matter not required to be searched by this Authority, namely:

Although claims 20, 21 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Although claims 20,21 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.

Continuation of Box II.2

Present claims 1-3,14 relate to an extremely large number of possible compounds/products/apparatus/methods. Support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found, however, for only a very small proportion of the compounds/products/apparatus/methods claimed. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Consequently, the search has been carried out for those parts of the claims which appear to be supported and disclosed, namely those parts relating to the compounds and methods closely related the examples as mentioned in the description. Moreover, it has to be noted that according the extreme broad characterisation of the above claims a lot of possible novelty destroying documents would be found.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2004/001687

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 02083651 A	24-10-2002	WO 02083651 A2	24-10-2002
		CA 2444148 A1	24-10-2002
		EP 1385831 A2	04-02-2004
		US 2003153584 A1	14-08-2003
		US 2003194375 A1	16-10-2003